United States Department of Agriculture

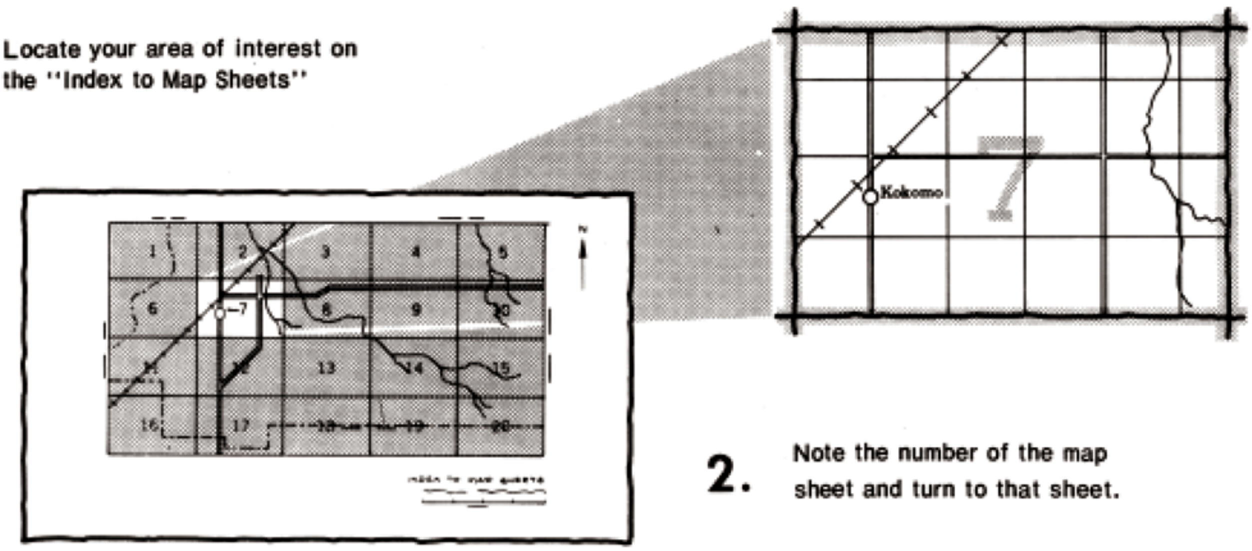
Forest Service and Soil Conservation Service

In cooperation with Wyoming Agricultural Experiment Station

Soil Survey of Bighorn National Forest, Wyoming

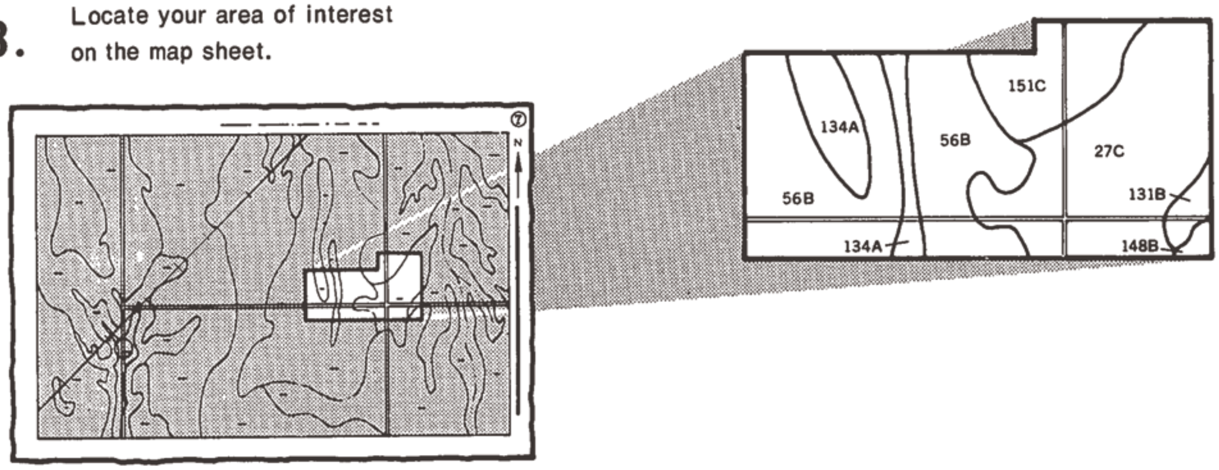
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets"

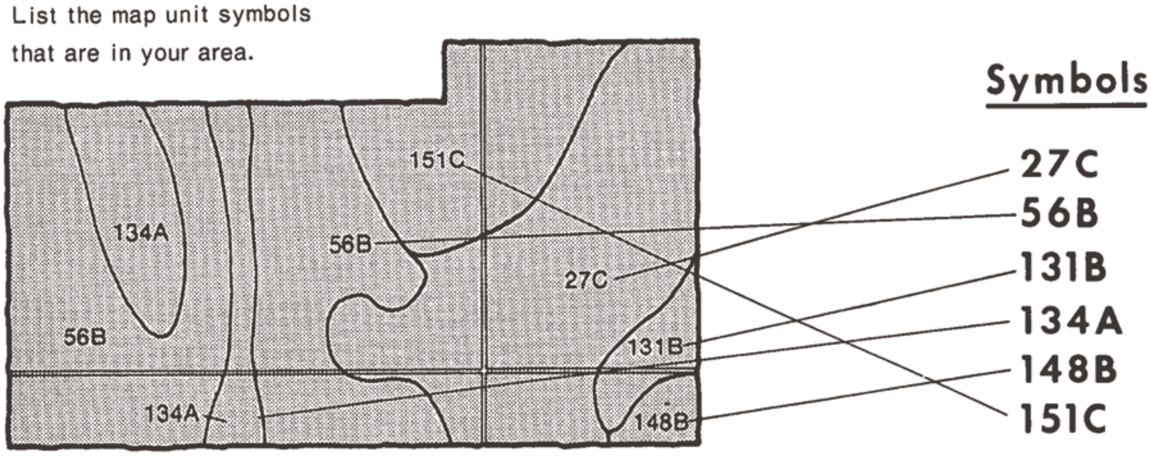


2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.

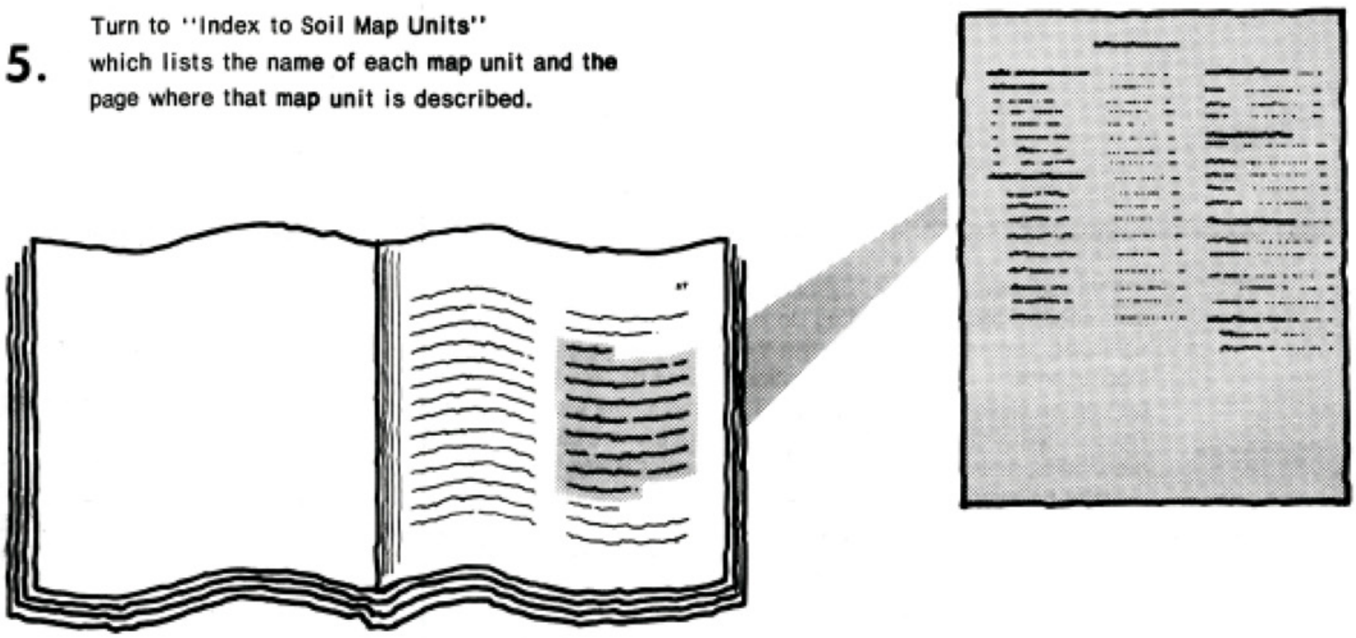


4. List the map unit symbols that are in your area.

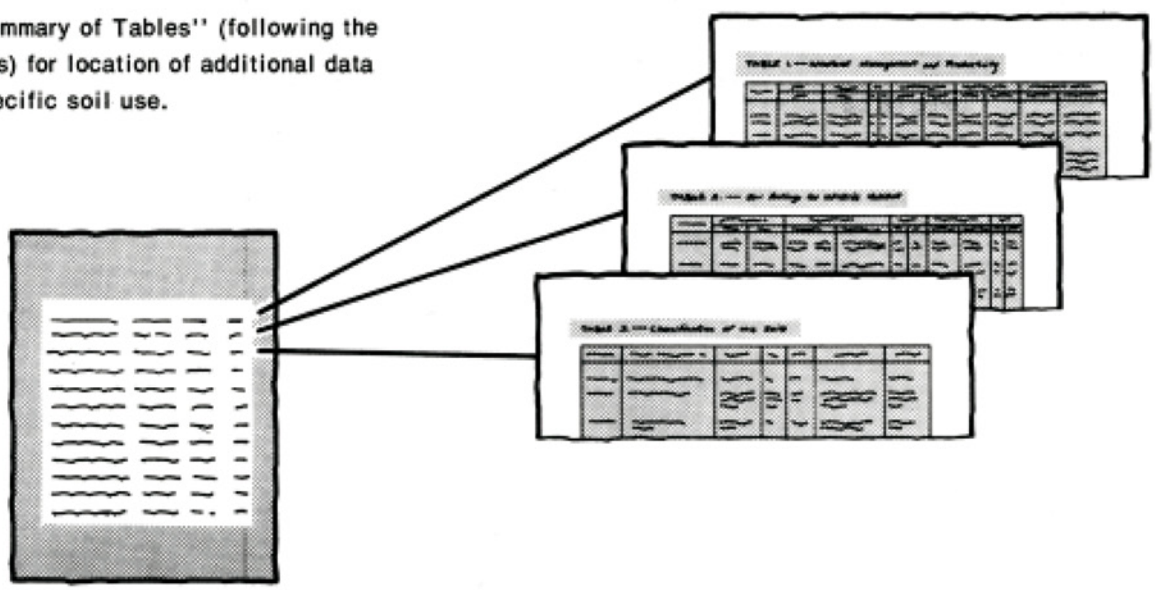


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1981. Soil names and descriptions were approved in 1982. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1982. This survey was made cooperatively by the Soil Conservation Service and the Forest Service. It is part of the technical assistance furnished to the National Forest Service Administration.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Typical area of Cirque land, 10 to 130 percent slopes. Glacier Lake in foreground, and Cloud Peak in background.

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Issued April 1986

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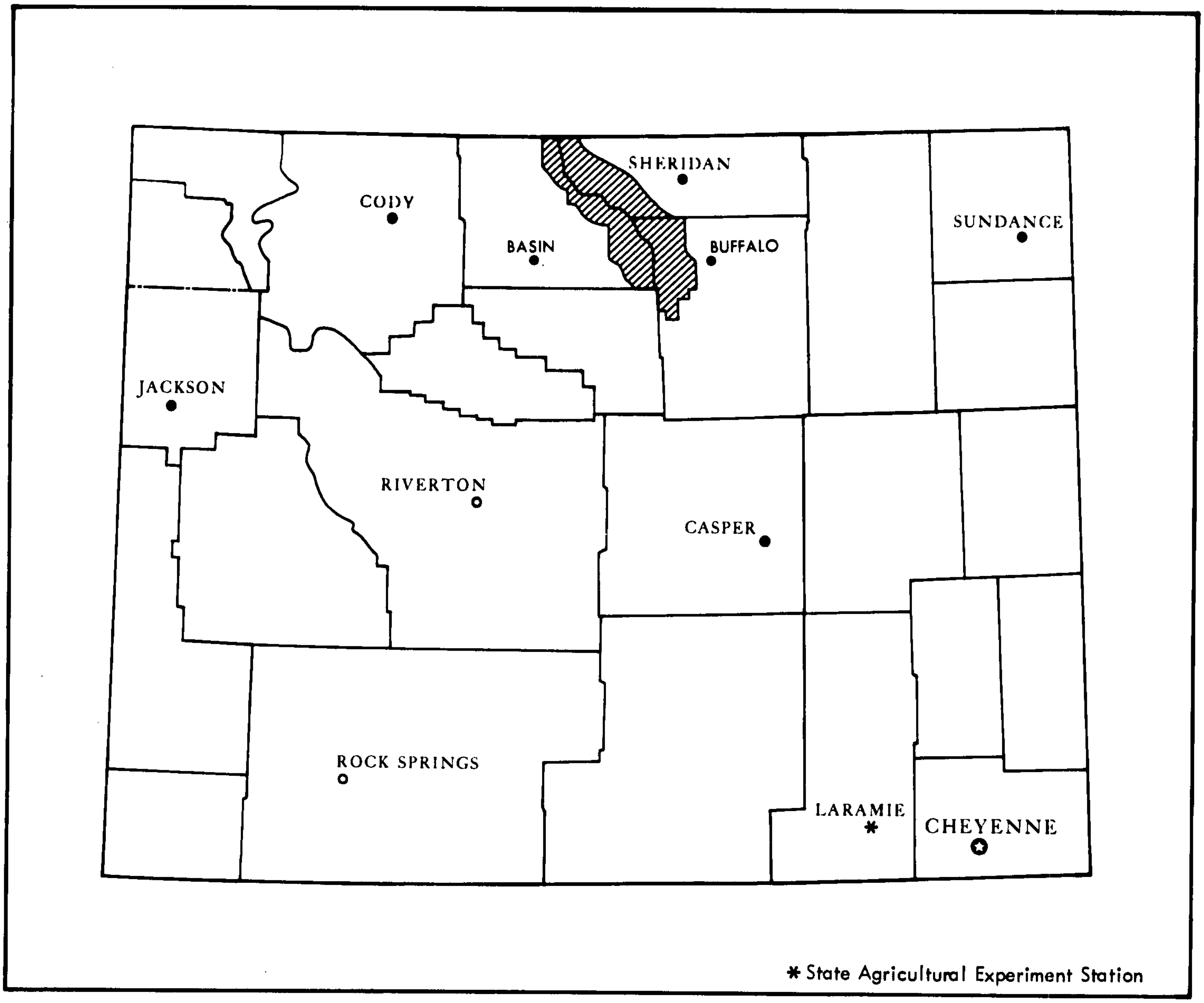
Preface

This soil survey contains information that can be used in planning timber sales, range programs, and other land uses on the Bighorn National Forest. It contains predictions of soil behavior for selected land uses. The survey also highlights the limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey has been prepared primarily for National Forest land managers, planners, engineers, foresters, and range conservationists. Teachers, students, and other members of the public can also use this survey to help them understand the soils and environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Timber and forage productivity varies on different soils.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of soil map units is shown on the detailed soil maps. The soils in the survey area are described and information on specific uses is given for each soil. Help in using this publication and additional information are available from the Bighorn National Forest Service soil scientist.



Location of Bighorn National Forest in Wyoming.

Soil Survey of Bighorn National Forest, Wyoming Parts of Big Horn, Johnson, Sheridan, and Washakie Counties

By John A. Nesser, Forest Service

Fieldwork by John A. Nesser, John J. Rawinski, and Wardman Fong, Forest Service

United States Department of Agriculture, Forest Service and Soil Conservation Service
In cooperation with
Wyoming Agricultural Experiment Station

BIGHORN NATIONAL FOREST is in the north-central part of Wyoming and includes parts of Big Horn, Johnson, Sheridan, and Washakie Counties. The total area is 1,115,073 acres, or about 1,742 square miles. There are no towns in the National Forest, but Buffalo, Worland, Greybull, Lovell, and Sheridan are nearby. The office of the Forest Supervisor is located in Sheridan.

Approximately 99 percent of the survey area is under the administration of the Forest Service. The survey area is used for recreation, livestock grazing, timber production, watershed, and wildlife habitat. Mining and mineral exploration are also permitted by Federal law.

Descriptions, names, and map unit delineations in this soil survey do not fully agree with those on soil maps for adjacent survey areas. Differences are the result of better knowledge of soils, modifications in series concepts, intensity of mapping, or the extent of soils in the survey area.

General Nature of the Survey Area

This section provides general information about the survey area. It discusses geomorphology, geology, drainage, climate, and vegetation.

Geomorphology

The Bighorn Mountains consist mainly of a granite core covered by sedimentary rock. They are nearly level on top but generally dip more steeply on the flanks. The sedimentary rock approximately covers the northern one-third and southern one-third of the range. In these parts subsummit areas of nearly uniform elevation form a belt 10 to 20 miles wide. Elevation averages 9,000 feet in the north and 8,000 feet in the south. The slope of these subsummit areas approximately follows the contour of the very gentle dip in the rocks. The middle third of the range is the crest, which has an elevation of approximately 10,500 to 12,000 feet. The highest peaks are Cloud Peak (13,167 feet) and Black Tooth Mountain (13,005 feet) (*11*).

Tilted sedimentary rock layers form steep flatirons and escarpments on the eastern and western flanks. Steep-sided canyons that expose the sedimentary strata are common.

Most of the subsummit surface is gently sloping to moderately steep. Tertiary terraces are present in the southern part of the range. Landslide deposits are common in areas underlain by Gros Ventre Shale, particularly in Shell Canyon and in the northern part of the range.

Alpine glaciation occurred during the Pleistocene in the central part of the Bighorn Mountains. Deep cirques with precipitous headwalls and *U*-shaped valleys are present, particularly along the eastern flank (*4*). There are many nearly vertical cirque walls. Most of these are 1,000 feet high, but a few are more than 1,500 feet high. The smooth crest has a scalloped appearance. Numerous lakes are in granite basins and in areas of dams of moraines. Scoured bedrock and lateral and terminal moraines are common. As none of the glaciers descended below an altitude of 6,500 feet, the lower

ends of the canyons retained their angular preglacial form. Within this glaciated part of the Bighorn Mountains are areas that were not glaciated. Felsenmeer is common in these areas. Other periglacial features such as tors, frost riven cliffs, rock streams and garlands, and talus also occur in these nonglaciated areas.

Geology

The Precambrian core of the Bighorn Mountains consists mainly of granite and gneiss, although other rocks, including migmatite, amphibolite, schist, quartz-diorite, and quartz monzonite are also present. The granite consists largely of two varieties—coarse-grained red granite and medium-grained to fine-grained gray granite. These two granites grade into one another in mineral composition and texture. The gneiss is highly variable, ranging from faintly banded gneissic granite to sharply banded gneiss. The Precambrian core of the Bighorn Mountains contains numerous dark gray to black mafic dikes that vary in width from a few feet to about 500 feet (*7*).

Flathead Sandstone overlies the Precambrian granite and is part of the unit referred to by Darton (*4*) as the Deadwood Formation. This unit consists of coarse-grained, gray quartzitic sandstone that is reddish brown when weathered. Lenses of the indurated sandstone are quartzitic and, on ridgetops, weather to flaggy plates that mantle the surface. In some areas reddish conglomerate underlies the sandstone. The upper 20 feet of the Flathead Sandstone is tan, medium-grained quartzitic sandstone that crops out as small resistant ledges along canyon walls.

The Gros Ventre Formation and the Gallatin Limestone overlie the Flathead Sandstone and originally were classified by Darton (*4*) as part of the Deadwood Formation. Rocks of the two formations weather readily and form smooth to hummocky, grass-covered slopes on which landslides and slumps are common. The base of the Gros Ventre Formation is at the lowermost occurrence of glauconite above the Flathead Sandstone. Above this base are medium-grained glauconitic sandstone and greenish-gray glauconitic shale. The upper part of the stratigraphic sequence consists of pinkish-gray, slabby, thin-bedded limestone, a few thin beds of sandstone, and thin beds of limestone conglomerate. This sequence is equivalent to the Gallatin Limestone of other areas.

The Bighorn Dolomite crops out as high, prominent cliffs along the slopes of the Bighorn Mountains. The dolomite overlies the Gallatin Limestone and is overlain by the Madison Limestone. The lowermost unit of the Bighorn Dolomite consists of sandstone that has shale layers as much as 30 feet thick. Above the basal sandstone, the Bighorn Formation is massive, tan to light gray, high purity, finely crystalline, cliff-forming dolomite. Weathered exposures have a pitted surface, which is characteristic of this formation. A unit of slabby argillaceous dolomite about 30 feet thick overlies the massive dolomite. Large talus blocks are common on the slopes below the cliffs.

The Madison Limestone constitutes the greater part of the high anticlinal front range of the Bighorn Mountains. It consists mainly of massive gray limestone that has some interbedded dolomite. In the upper part of the formation is pure limestone that weathers into characteristic pinnacled forms. Caverns and solution cavities are common, and they form a typical karst topography in some areas.

Overlying the Madison Limestone and generally extending up the outer slopes of the mountains is the highly resistant Amsden Formation. The lower part is bright red shale about 60 feet thick that commonly has layers of limestone, siltstone, and sandstone. The upper part is thin-bedded sandy limestone, which in places contains extensive deposits of chert that weathers out and accumulates on the surface.

The Tensleep Sandstone overlies the Amsden Formation and commonly forms conspicuous flatirons that flank the Bighorn Mountains. The formation is composed of massive, cross-bedded, white to buff-colored sandstone that commonly weathers into irregular forms.

The Chugwater Formation comprises the red beds of the front of the Bighorn Mountains. It consists mainly of soft, massive, red sandstone that commonly crops out as a line of prominent cliffs. Interbedded in the sandstone are layers of limestone and red sandy shale containing deposits of gypsum.

Surficial deposits are throughout the Bighorn Mountains. Several deposits of alluvium containing subangular to well-rounded boulders of Precambrian granite and gneiss that have a poorly sorted sand and gravel matrix are present in the southern parts of the mountains. Volcanic ash is interbedded in these deposits in some places. These deposits were recognized as Tertiary in age by Darton (*4*).

During the Pleistocene there were at least two periods of glaciation—the Bull Lake Stade and the Pinedale Stade. The Bull Lake Stade is the older of the two. Glaciers scoured existing valleys and deposited extensive moraines. The till of the Bull Lake Stade is more highly weathered, has fewer boulders on the surface, and is more eroded than the till of the Pinedale Stade. The Pinedale Till characteristically contains many potholes and lakes. Holocene deposits are present in most valleys in the survey area.

Drainage

The Bighorn Mountains are a part of the Missouri Water Resource Region. The western side of the mountain range drains into the Bighorn River, and the eastern side drains into the Tongue and Powder Rivers.

Some of the tributaries to the Bighorn River are Porcupine, Shell, Medicine Lodge, Paintrock, and Tensleep Creeks. The Little Bighorn River, although on the eastern side of the range, flows into the main stem of the Bighorn River. Lodgegrass and Pass Creeks are tributary to the Little Bighorn River. Goose and Wolf Creeks drain into the Tongue River, which is in the northern part of the eastern side of the mountain range. Rock, Clear, and Crazy Woman Creeks drain into the Powder River. Most of the survey area is drained. Subsurface drainage into aquifers occurs within the sedimentary rock that dips away from the Bighorn Mountains. On the western side these drain into the Bighorn Basin, and on the eastern side, into the Powder River Basin.

There are many lakes in the survey area, especially in and around the glaciated areas. In the glacial deposits to the north and east of the glaciated areas are potholes and other poorly drained areas. The Bighorn Mountains area is a very important water-producing area.

Climate

The climate in the survey area is that of a highland area surrounded by a midlatitude steppe. This surrounding area is an interior, midlatitude desert and steppe region that mountains protect from invasions of maritime airmasses. It is dominated by continential tropical airmasses in summer and by continental polar airmasses in winter. The annual temperature range is wide; summers are hot and winters are cold. The Bighorn Mountains make up the highland area. The range in temperature is less in this area; summers are cool. Also, precipitation is higher and is more uniform throughout the year.

In winter, cold airmasses from Canada bring strong northerly and northwesterly winds, low temperatures, and snow. Warm winds from the west and southwest often follow the passage of these fronts and moderate the weather. Airmasses from the Pacific Ocean and the Gulf of Mexico rarely reach the survey area. Upslope conditions that cause precipitation occur frequently in winter and spring on the eastern side of the Bighorn Mountains. In summer, local thunderstorms that move in a northeasterly direction occur in the mountains. Tornadoes have occurred in scattered locations. Table 1 contains information on air temperatures and precipitation at Burgess Junction, Wyoming.

The average annual temperature varies from 47 degrees F at Hyattville to 34 degrees at Burgess Junction and Dome Lake. Generally, the mean annual air temperature decreases about 3 degrees per 1,000-foot increase in elevation. Recorded extreme temperatures are -42 degrees and 99 degrees at Hunter Ranger Station and -42 degrees and 90 degrees at Dome Lake. The growing season at these elevations is about 50 to 55 days. July is the warmest month and is marked by an average daily high temperature of about 70 degrees; January is the coldest month and is marked by an average daily minimum temperature of about 0. Freezing temperatures can occur in any month of the year.

Annual precipitation ranges from about 10 inches to more than 40 inches. Commonly, one-half to two-thirds of the annual precipitation is snow. The wettest months, in order, are June, May, April, and September. The driest are December, January, and February. Generally, the distribution of precipitation from month to month is more nearly uniform at the higher elevations. The western side of the Bighorn Mountains receives less precipitation than the eastern side because it lies within the rain shadow of the higher Absaroka Mountains, 75 miles to the west, and because precipitation caused by upslope conditions is less frequent. Average snow depth on May 1, based on snow course measurements, ranges from 14 to 81 inches, with an overall average of 47 inches. There are perennial snowfields on the flanks of Cloud Peak, Blacktooth Peak, and other peaks in the central part of the mountains.

Vegetation

Forest makes up about 60 percent of the survey area between the lower grasslands and the alpine zone. Major tree species are lodgepole pine, subalpine fir, Engelmann spruce, and Douglas-fir. Ponderosa pine grows in narrow bands at the lower elevations. Other species include Rocky Mountain juniper, limber pine, and narrowleaf cottonwood (*5*).

Grasslands and shrublands make up about 40 percent of the survey area. Major species are Idaho fescue, bluebunch wheatgrass, tufted hairgrass, Utah juniper, mountainmahogany, big sagebrush, and black sagebrush. Alpine plant communities are present above the timberline.

Table 4 shows the major plant associations that are present on each soil.

Ponderosa pine forests are present at elevations of 4,300 to 6,000 feet on the eastern slope of the Bighorn Mountains and extending down to the alluvial fans at the base of the mountains. There are few juniper trees below the ponderosa pine on the eastern slope; rather, the forest ends abruptly in grassland at the base of the mountains. On the western side of the mountains, these forests are nearly absent except in the southern quarter. In this area a well-developed juniper-sagebrush plant association is present between the valley floor and the ponderosa pine forests. Common shrubs, forbs, and grasses in the understory include common juniper, mountain ninebark, Oregon-grape, spirea, Idaho fescue, and bluebunch wheatgrass.

Douglas-fir forests are present at elevations between 6,100 and 8,900 feet, but they are most common between elevations of 6,500 and 8,500 feet. On the eastern flanks of the range, they form a band between

the lodgepole pine above and the ponderosa pine below. On much of the western flanks, they are the lowest closed forest type. Here they are present along the north-facing side slopes of the many canyons that have been cut through the sedimentary rock. At the lower elevations, they are almost restricted to these sites. They are best developed on the soils derived from limestone and only rarely are present on soils derived from granite. They extend the full length of the mountains on both sides and are present on the summits of the southern third. On the rocky windswept ridges at the lower elevations of this zone, limber pine ranges from a minor to a dominant overstory species. In mesic areas at the higher elevations, Engelmann spruce is the most common species. Common shrubs and forbs include common juniper, current, Oregon-grape, mountain ninebark, heartleaf arnica, and mountain snowberry.

Lodgepole pine forests are best developed on the soils derived from granite in the central third of the mountains. Here they form an almost continuous forest that has only small parks scattered throughout. On the northern third, small stands are present as islands in the Englemann spruce-subalpine fir forests or are alone; they are commonly associated with soils derived from granite or Flathead Sandstone. Lodgepole pine stands are present on the southern third of the mountains on soils derived from granite or Tensleep Sandstone. They extend from 6,500 feet to timberline, but they are most prevalent between 7,000 and 9,500 feet, where they form a wide band between the Engelmann spruce-subalpine fir forests above and the Douglas-fir forests below. Where an understory is present, it is composed of saplings of Engelmann spruce, subalpine fir, and lodgepole pine and shrubs and forbs including grouse whortleberry, kinnikinnick, common juniper, and silvery lupine.

Engelmann spruce-subalpine fir forests are present from about 7,000 feet to timberline at 10,000 feet, but they most commonly are present between 8,300 and 9,500 feet. They are best developed on north-facing slopes, especially at lower elevations or in areas of Gros Ventre Shale on the northern third of the mountains. An occasional lodgepole pine is present in places but in no consistent pattern. In some areas where limestone is present above 9,500 feet, the forests also contain some Douglas-fir. The understory in these areas is sparse, consisting mostly of saplings of the overstory trees. Common shrubs and forbs include grouse whortleberry, heartleaf arnica, russet buffaloberry, wintergreen, fireweed, elk sedge, Oregon-grape, common juniper, twinflower, gooseberry currant, and wheeler bluegrass.

Quaking aspen is not a major tree species in the survey area. It forms small stands and groves within the elevation zones where ponderosa pine, Douglas-fir, and lodgepole pine are present, commonly on the moister sites, which are characterized by deeper soils. These stands are mainly successional to coniferous trees. Common understory species include lupine, Idaho fescue, common snowberry, common juniper, and shrubby cinquefoil.

Riparian areas commonly have a forest cover. Blue spruce distinguishes riparian stands on the eastern slope and on soils derived from granitic rock. A mixture of shrubs such as current and mountain ninebark is common. On the western slope, particularly on soils derived from limestone, narrowleaf cottonwood and Rocky Mountain maple with an understory of river birch, currant, mountain ninebark, and willows is more characteristic. There are also a few isolated stands of narrowleaf cottonwood at the lower elevations on the eastern slope.

Rocky Mountain juniper and Utah juniper are present along the lower western flank. They are in a broken band that extends from north to south between elevations of 4,500 and 6,300 feet. A few juniper stands are also present on the eastern flank. The soils under these stands generally are shallow and have low available water capacity. Commonly associated plants are big sagebrush, black sagebrush, phlox, pricklypear, Sandberg bluegrass, and bluebunch wheatgrass.

Idaho fescue is present from about 6,000 feet to the grasslands above timberline. It is dominant in many of the mountain meadows and grasslands both below and above timberline. In other areas it may be subdominant under mountainmahogany or sagebrush. The major plant species associated with Idaho fescue are sedges, silky lupine, yarrow, and agoseris. Forbs are characteristic of soils derived from sedimentary material, whereas spikemoss and oatgrass are characteristic of soils derived from granite. Bluebunch wheatgrass is characteristic of the lower slopes. Major associated plants on the western flank are prairie junegrass, Sandberg bluegrass, sedges, needleandthread, pricklypear, phlox, and scarlet globemallow. On the eastern flank, little bluestem and yucca are in some areas; however, the eastern flank is dominantly forested to the foot of the mountains.

Tufted hairgrass grows in wet meadows and riparian areas throughout the Bighorn Mountains, primarily on soils derived from glacial till and granite. Common associated plants include alpine timothy, sedges, bistort, iris, and shrubby cinquefoil. In the wetter riparian areas, rushes and willows are dominant.

Mountainmahogany is present at elevations of about 6,000 to 7,000 on the shallow, rocky, steeper slopes of the western flank. It is mostly associated with calcareous soils. A few scattered stands occur in areas of limestone outcrops on the eastern flank at about 5,000 feet. Common associated plants are Idaho fescue, bluebunch wheatgrass, Sandberg bluegrass, prairie junegrass, sedges, sagewort, and daisy.

Big sagebrush is present in areas extending from the base of the mountains to near timberline, mostly on soils

derived from sedimentary rock or glacial deposits. A few stands of black sagebrush are present at the lower elevations on the western slope. The associated species are those of the grassland in the particular area in which big sagebrush grows. Idaho fescue grassland species commonly are at the higher elevations and bluebunch wheatgrass grassland species at the lower elevations.

Alpine plant communities occur above timberline and are of three types. The Geum turf community is the driest type, and common species in it include avens, sedges, Idaho fescue, alpine bluegrass, stonecrop, phlox, and moss campion. The hairgrass meadow community is wetter and is dominated by tufted hairgrass and sedges. The sedge bog community is the wettest of the three communities and is dominated by sedges and rushes. Willows are also dominant in some areas of this plant community.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area (*8*). Each kind of soil and miscellaneous area is associated with a particular kind or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge gradually onto one another as their characteristics gradually change. To construct an accurate map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size, and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While the soil survey was in progress, samples of some of the soils in the area were collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses and under different levels of management. Some interpretations were modified to fit local conditions, and some new interpretations were developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The soils or miscellaneous areas making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils or miscellaneous areas can be identified on the map. Likewise, areas that are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a timber stand or for selecting a site for a road or campground. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Map Unit Descriptions

1. Rubble land-Rock outcrop-Cirque land

Miscellaneous areas on moderately sloping to nearly vertical mountainsides near or above timberline

Most of this map unit is in the uplifted granitic core of the Bighorn Mountains. Elevations range from 9,000 to 13,167 feet, and the average annual precipitation ranges from 25 to 40 inches.

This map unit makes up about 12 percent of the survey area. It is 29 percent Rubble land, 22 percent Rock outcrop, and 19 percent Cirque land. The remaining 30 percent is components of minor extent.

The Rubble land consists of very angular cobbles, stones, and boulders on unglaciated slopes and summits above timberline. There is little or no vegetation except for mosses and lichens.

The Rock outcrop is on glacial trough valley slopes and is generally smooth because of glacial scouring.

The Cirque land consists of a glacial cirque headwall with associated talus and a cirque basin that commonly contains a small, round lake or tarn. Little or no vegetation grows in these areas except for a small amount of alpine vegetation on soils of minor extent.

Of minor extent in this unit are Agneston, Mirror, and Teewinot soils. They are on the more protected mountainsides and in depressional areas.

This map unit is used for recreation, wildlife habitat, and watershed. It is important hydrologically as a collection and storage area for accumulated snow, and the trough valleys and cirque basins provide a summer habitat for elk. Steepness and rockiness are the main limitations for many uses.

2. Frisco-Troutville-Fourmile

Deep, well drained soils that formed in glacial till and alluvium derived from granite; on moraines and old terraces

This map unit is in the central and southern parts of the survey area. It is in the glacial valleys adjacent to or partly within the uplifted granitic core of the Bighorn Mountains and extend from there down the valley. The Frisco and Troutville soils support lodgepole pine vegetation, and the Fourmile soils support big sagebrush and Idaho fescue vegetation. Elevations range from 6,500 to 9,000 feet, and the average annual precipitation ranges from 15 to 30 inches.

This map unit makes up about 9 percent of the survey area. It is 36 percent Frisco soils, 25 percent Troutville soils, and 16 percent Fourmile soils. The remaining 23 percent is components of minor extent.

The Frisco soils are deep and well drained. They formed in glacial till in sloping areas on forested moraines. The surface layer is loam. The subsurface layer is cobbly and very cobbly sandy loam. The subsoil is very stony sandy clay loam. The substratum is extremely stony sandy loam.

The Troutville soils are deep and well drained. They formed in glacial till in the steeper areas on moraines. The surface layer is very stony sandy loam. The subsoil is extremely stony sandy loam and lamellae of sandy clay loam.

The Fourmile soils are deep and well drained. They formed in glacial till or alluvium on terraces and moraines. The surface layer is loam. The subsurface layer is gravelly loam. The subsoil is very cobbly sandy clay loam overlying an extremely cobbly loamy coarse sand substratum.

Of minor extent in this unit are Tine soils on convex side slopes and soils that are similar to the Frisco soils

but do not have a clayey subsoil. Glacial ponds and surface boulders are common in this unit.

The Frisco and Troutville soils are used mainly for timber production. The main limitations are slope and the large volume of coarse fragments. The Fourmile soils are used mainly for livestock grazing. All the soils provide wildlife habitat for deer and elk.

3. Owen Creek-Tongue River-Gateway

Moderately deep, well drained soils that formed in material derived from interbedded shale, sandstone, and limestone; on mountainsides and landslide deposits

This map unit is in the northern half of the survey area. The Owen Creek soils support big sagebrush and Idaho fescue, the Tongue River soils are forested with lodgepole pine, and the Gateway soils are forested with Engelmann spruce. Elevation ranges from 5,600 to 9,500 feet, and the average annual precipitation ranges from 15 to 35 inches.

This map unit makes up about 10 percent of the survey area. It is 25 percent Owen Creek soils, 14 percent Tongue River soils, and 13 percent Gateway soils. The remaining 48 percent is components of minor extent.

The Owen Creek soils are moderately deep and well drained. They formed in colluvium derived from interbedded shale and sandstone on mountainsides and landslide deposits. The surface layer is clay loam. The subsoil is clay. The substratum is channery clay.

The Tongue River soils are moderately deep and well drained. They formed in residuum derived from soft interbedded sandstone and shale on mountainsides. The surface layer is loam. The subsurface layer and subsoil are sandy clay loam. The substratum is sandy loam.

The Gateway soils are moderately deep and well drained. They formed in residuum derived from interbedded shale and limestone on mountainsides. The surface layer is loam and clay loam. The subsoil and substratum are clay.

Of minor extent in this unit are Echemoor soils on fans and toe slopes; Starman and Nathrop soils on limestone ridges and back slopes; Bynum, Carbol, and Inchau soils on sandstone back slopes; and Rock outcrop.

This unit is used for livestock grazing, timber production, wildlife habitat, and recreation. The main limitations are the hazard of landslides, the hazard of erosion, and steepness of slope.

4. Cloud Peak-Starley-Rock outcrop

Moderately deep and shallow, well drained soils that formed in material derived from limestone; on mountainsides and ridges

This map unit occurs throughout the survey area, but it is most extensive in the northern part. The Cloud Peak soils support forests of Engelmann spruce, subalpine fir, and Douglas-fir. The Starley soils support Idaho fescue and sedges. Elevation ranges from 4,600 to 10,500 feet, and the average annual precipitation ranges from 12 to 38 inches.

This map unit makes up about 29 percent of the survey area. It is 35 percent Cloud Peak soils, 9 percent Starley soils, and 8 percent Rock outcrop. The remaining 48 percent is components of minor extent.

The Cloud Peak soils are moderately deep and well drained. They formed in residuum or colluvium derived from limestone on mountainsides. The surface layer is gravelly silt loam. The subsoil is very gravelly silty clay loam. The substratum is very cobbly silt loam.

The Starley soils are shallow and well drained. They formed in residuum and colluvium derived from limestone on mountainsides and ridges. The surface layer is loam. The substratum is extremely cobbly loam.

Rock outcrop consists of limestone cliffs and escarpments.

Of minor extent in this unit are Starman soils on ridges and back slopes, Passcreek and Leavitt soils on mountainsides and fans, Hanson and Raynesford soils on old terraces, Farlow and Pishkun soils on old landslide deposits, Hanson Variant soils on steep mountainsides, Bottle and Sapphire soils on forested side slopes, Nathrop Variant and Nielsen soils on grass-covered side slopes, and Tolman, Beenom Variant, Carbol Variant, Grobutte, Starman Variant, Chilton Variant, Sunup, and Spearfish Variant soils at the lower elevations, where the soil temperature is warmer.

This map unit is used for sheep and cattle grazing, timber production, recreation, and wildlife habitat. The main limitations are slope and the large volume of coarse fragments.

5. Rock outcrop-Mirror-Teewinot

Rock outcrop, and moderately deep and shallow, well drained soils that formed in material derived from granite; on mountainsides and ridges near timberline

This map unit is adjacent to the uplifted granitic core of the Bighorn Mountains, in the central and southern parts of the survey area. Both the Mirror and Teewinot soils support alpine vegetation consisting of sedges, avens, and Idaho fescue. Elevation is 9,200 to 11,000 feet, and the average annual precipitation ranges from 28 to 35 inches.

This map unit makes up about 6 percent of the survey area. It is 29 percent Rock outcrop, 26 percent Mirror soils, and 19 percent Teewinot soils. The remaining 26 percent is components of minor extent.

Rock outcrop commonly is in the more strongly windswept areas on convex mountain ridges and peaks. It is mostly granite, but schist, gneiss, and quartz-diorite also are present.

The Mirror soils are moderately deep and well drained. They formed in colluvium or residuum derived from granite on mountainsides and in saddles between areas

of Rock outcrop. The surface layer is cobbly loam. The subsoil is very cobbly loam.

The Teewinot soils are shallow and well drained. They formed in residuum derived from granite on mountainsides and ridges. The surface layer and subsoil are very cobbly loam.

Of minor extent in this unit are Bross soils on glacial moraines; wet soils in depressional areas, in seeps, and along drainageways; and Rubble land.

This map unit is used for livestock grazing, recreation, and wildlife habitat. The main limitations are the areas of Rock outcrop and steepness of slope.

6. Agneston-Granile-Rock outcrop

Moderately deep and deep, well drained soils that formed in material derived from granite, and Rock outcrop; on mountainsides

This map unit is throughout the survey area, but it is most extensive in the central and southern parts. The dominant vegetation is lodgepole pine and grouse whortleberry. Elevation ranges from 6,500 to 9,500 feet, and the average annual precipitation ranges from 15 to 35 inches.

This map unit makes up about 34 percent of the survey area. It is 29 percent Agneston soils, 17 percent Granile soils, and 15 percent Rock outcrop. The remaining 39 percent is components of minor extent.

The Agneston soils are moderately deep and well drained. They formed in residuum derived from granite and are in gently sloping to steep areas on mountainsides. The surface layer is sandy loam. The subsurface layer is gravelly coarse sandy loam. The upper part of the subsoil is very cobbly sandy clay loam, and the lower part is very cobbly fine sandy loam.

The Granile soils are deep and well drained. They formed in residuum derived from granite and are in gently sloping areas on mountainsides. The surface layer is gravelly sandy loam. The subsurface layer is very gravelly coarse sandy loam. The subsoil is very cobbly sandy clay loam. The substratum is very cobbly sandy loam.

Rock outcrop consists of rounded exposures of granite.

Of minor extent in this unit are Tellman soils on outwash plains and Lucky, Burgess, Hazton, and Leighcan soils on mountainsides.

This map unit is used for timber production, livestock grazing, wildlife habitat, and recreation. The main limitations are slope, areas of Rock outcrop, and the large volume of coarse fragments in the soils.

Detailed Soil Map Units

The map units delineated on the detailed maps at the back of this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit is given under "Use and Management of the Soils."

A map unit delineation on a map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavior divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation to precisely define and locate the soils and miscellaneous areas is needed.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying layers, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are associations or undifferentiated groups.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Frisco-Troutville association is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Cryaquolls is an undifferentiated group in this survey area.

This survey includes *miscellaneous areas*. Such areas have little or no soil matetial and support little or no vegetation. Rubble land is an example.

Table 2 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables")

give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

Map Unit Descriptions

10—Agneston-Granile-Rock outcrop association, 5 to 50 percent slopes. This map unit is on mountainsides (fig. 1). The natural vegetation is mainly lodgepole pine and grouse whortleberry. Elevation is 7,000 to 9,500 feet. The average annual precipitation is about 15 to 30 inches.

This unit is 35 percent Agneston sandy loam, 25 percent Granile gravelly sandy loam, and 25 percent Rock outcrop. The Agneston soil is in the steeper, convex areas; the Granile soil is in the more gently sloping areas; and Rock outcrop is on ridgetops and side slopes. Included in this unit are small areas of Leighcan soils, Tellman soils, and soils that are similar to the Agneston soil but are reddish. Included areas make up about 15 percent of the unit.

The Agneston soil is moderately deep and well drained. It formed in residuum derived dominantly from granite. Typically, the surface is covered with a mat of

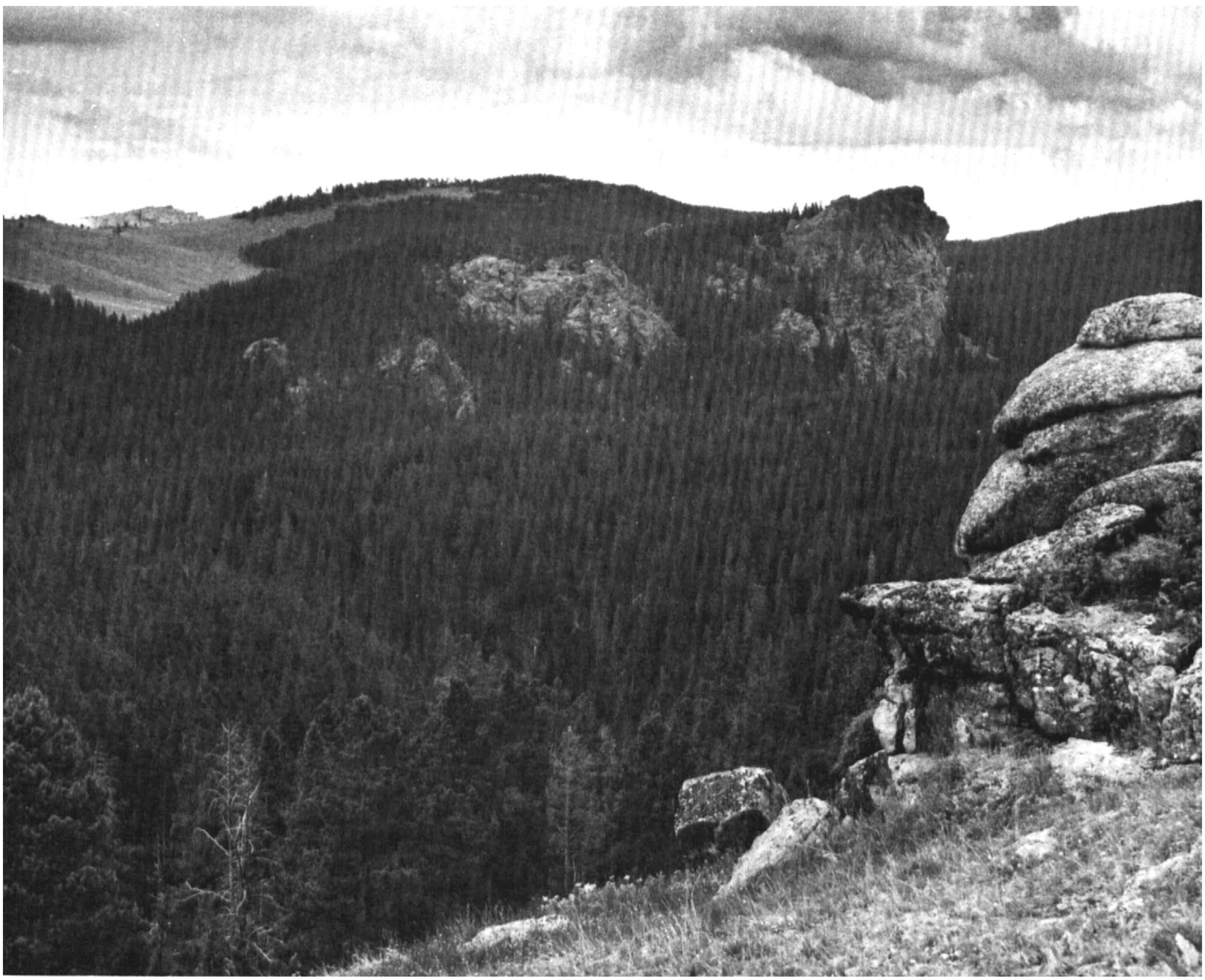


Figure 1.—Typical area of Agneston-Granile-Rock outcrop association, 5 to 50 percent slopes.

mosses and litter about 1 inch thick. The surface layer is very dark grayish brown sandy loam about 2 inches thick. The subsurface layer is brown gravelly coarse sandy loam about 5 inches thick. The upper part of the subsoil is dark yellowish brown very cobbly sandy clay loam about 15 inches thick, and the lower part is dark brown very cobbly fine sandy loam about 6 inches thick. Fractured granite is at a depth of 20 to 40 inches.

Permeability of the Agneston soil is moderately slow. The hazard of water erosion is slight to moderate.

The average annual production of wood fiber is about 27 cubic feet per acre for lodgepole pine.

The Granile soil is deep and well drained. It formed in residuum derived dominantly from granite. Typically, the surface is covered with a mat of needles and twigs about 1 inch thick. The surface layer is dark yellowish brown gravelly sandy loam about 2 inches thick. The subsurface layer is dark yellowish brown and yellowish brown very gravelly coarse sandy loam and very gravelly sandy clay loam about 10 inches thick. The subsoil is yellowish brown very cobbly sandy clay loam about 8 inches thick. The substratum is brown very cobbly sandy loam about 25 inches thick. Granite is at a depth of 40 to 60 inches.

Permeability of the Granile soil is moderate. The hazard of water erosion is slight.

The average annual production of wood fiber is about 29 cubic feet per acre for lodgepole pine.

Rock outcrop is intermingled throughout the unit. It is barren exposures of granite or gneiss.

The major limitations for producing and harvesting timber on this unit are steepness of slope and the areas of Rock outcrop.

11—Agneston-Leighcan association, 5 to 30 percent slopes. This map unit is on mountainsides (fig. 2). The natural vegetation is mainly Engelmann spruce and grouse whortleberry. Elevation is 8,000 to 9,500 feet. The average annual precipitation is about 20 to 35 inches.

This unit is 40 percent Agneston sandy loam, 30 percent Leighcan gravelly loam, and 15 percent included areas of Rock outcrop and Rubble land. The Agneston soil is in gently sloping to moderately sloping areas, the Leighcan soil is in the more steeply sloping areas, and Rock outcrop and Rubble land are on ridges and side slopes. Also included in this unit are small areas of wet Tellman soils, wet soils in seeps and meadows, and Mirror soils; these included areas make up about 15 percent of the unit.

The Agneston soil is moderately deep and well drained. It formed in residuum derived dominantly from granite. Typically, the surface is covered with a mat of mosses and litter about 1 inch thick. The surface layer is very dark grayish brown sandy loam about 2 inches thick. The subsurface layer is brown gravelly coarse sandy loam about 5 inches thick. The upper part of the subsoil is dark yellowish brown very cobbly sandy clay loam about 15 inches thick, and the lower part is dark brown very cobbly fine sandy loam about 6 inches thick. Fractured granite is at a depth of 20 to 40 inches.

Permeability of the Agneston soil is moderately slow. The hazard of water erosion is slight to moderate.

The average annual production of wood fiber is about 36 cubic feet per acre for Engelmann spruce.

The Leighcan soil is deep and well drained. It formed in residuum and colluvium derived dominantly from granite. Typically, the surface is covered with a mat of needles and twigs about 1 inch thick. The surface layer is very dark brown gravelly loam about 3 inches thick. The subsurface layer is brown gravelly loam about 3 inches thick. The upper part of the subsoil is dark yellowish brown cobbly coarse sandy loam about 14 inches thick, and the lower part is brown very cobbly sandy loam about 10 inches thick. The substratum is very dark grayish brown very cobbly sand about 12 inches thick. Fractured gneiss and hornblende schist are at a depth of 40 to 60 inches.

Permeability of the Leighcan soil is moderately rapid. The hazard of water erosion is slight.

The average annual production of wood fiber is about 42 cubic feet per acre for Engelmann spruce.

Rock outcrop and Rubble land are intermingled throughout the unit. They are granite or gneiss and occur as barren exposures of bedrock and as talus.

This unit has no major limitations for producing and harvesting timber.

12—Chilton Variant-Sunup-Spearfish Variant association, 5 to 60 percent slopes. This map unit is on fans, foot slopes, and dissected mountainsides. The natural vegetation is mainly Utah juniper and big sagebrush. Elevation is 4,800 to 6,000 feet. The average annual precipitation is about 12 to 15 inches.

This unit is 40 percent Chilton Variant very channery loam, 30 percent Sunup very stony fine sandy loam, and 25 percent Spearfish Variant very stony fine sandy loam. The Chilton Variant soil is on fans and foot slopes, the Sunup soil is on steep side slopes, and the Spearfish Variant soil is on side slopes. Included in this unit are small areas of soils that do not have coarse fragments and that formed in reddish brown alluvium. Included areas make up about 5 percent of this unit.

The Chilton Variant soil is deep and well drained. It formed in alluvium or colluvium derived dominantly from limestone. The surface layer is dark brown very channery loam about 3 inches thick. The substratum is brown very channery and extremely channery loam about 39 inches thick. Limestone is at a depth of 40 to 60 inches.

Permeability of the Chilton Variant soil is moderate. The hazard of water erosion is slight.

The average annual production of air-dry vegetation ranges from 600 to 800 pounds per acre.

Figure 2.—Typical area of Agneston-Leighcan association, 5 to 30 percent slopes, in foreground. Area of Rock outcrop-Mirror-Teewinot association, 5 to 35 percent slopes, on ridge in background.

The Sunup soil is shallow and well drained. It formed in residuum derived dominantly from limestone. The surface layer is brown very stony fine sandy loam about 4 inches thick. The substratum is light brown very stony fine sandy loam about 6 inches thick. Cherty limestone is at a depth of 10 to 20 inches.

Permeability of the Sunup soil is moderately rapid. The hazard of water erosion is slight to moderate.

The average annual production of air-dry vegetation ranges from 600 to 800 pounds per acre.

The Spearfish Variant soil is shallow and well drained. It formed in residuum derived dominantly from red shale and sandstone. The surface layer is reddish brown gravelly loam about 4 inches thick. The substratum is red loam about 10 inches thick. Soft, red shale and interbedded sandstone are at a depth of 10 to 20 inches.

Permeability of the Spearfish Variant soil is moderate. The hazard of water erosion is slight to moderate.

The average annual production of air-dry vegetation ranges from 600 to 800 pounds per acre.

The major limitation for producing forage on the Sunup and Spearfish Variant soils is droughtiness. The Chilton Variant soil has no major limitations for this use.

13—Cirque land, 10 to 130 percent slopes. This map unit consists of glacial cirque headwalls that have been carved from granite and are associated with talus and cirque basins that commonly contain a small, round lake, or tarn. Little if any vegetation grows in these areas except for small amounts of alpine vegetation in areas of included soils.

This unit is above timberline. Elevation ranges from 10,000 to 13,000 feet. The average annual precipitation is about 30 to 40 inches.

Included in this unit are Mirror soils, Teewinot soils, and wet soils that have a surface layer of peat. Also included are small glaciers in the higher cirques.

Steepness of slope and the harsh alpine environment limit this unit for most uses other than recreation and watershed.

14—Cloud Peak gravelly silt loam, 5 to 45 percent slopes. This moderately deep, well drained soil is on mountainsides, dominantly on north and east aspects. It formed in residuum derived from limestone. The natural vegetation is mainly Douglas-fir and mountain ninebark at the drier, warmer, lower elevations and on south and west aspects, and it is mainly Englemann spruce and grouse whortleberry at the more moist, cooler, higher elevations and on north and east aspects. Elevation is 7,000 to 9,500 feet. The average annual precipitation is about 16 to 35 inches.

Included in this unit are small areas of shallow, stony soils and soils that are similar to this Cloud Peak soil but do not have so much gravel and cobbles or that have a thicker dark-colored surface layer.

Typically, the surface is covered with a mat of needles and leaf litter about 2 inches thick. The surface layer is dark brown gravelly silt loam about 2 inches thick. The subsoil is brown and yellowish brown very gravelly silty clay loam about 20 inches thick. The substratum is brown very cobbly silt loam about 16 inches thick. Hard, fractured limestone is at a depth of 20 to 40 inches.

Permeability of the Cloud Peak soil is moderate. The hazard of water erosion is slight to moderate.

The average annual production of wood fiber in cubic feet per acre is about 36 for Douglas-fir and 60 for Engelmann spruce.

The major limitation for producing and harvesting timber on this unit is steepness of slope.

15—Cloud Peak-Eutroboralfs-Argiborolls association, 10 to 65 percent slopes. This map unit is on mountainsides on the east side of the Bighorn Mountains. The natural vegetation is mainly Douglas-fir and mountain ninebark on the Cloud Peak soil and on the Eutroboralfs, and it is mainly bluebunch wheatgrass and Prairie junegrass on the Argiborolls. Elevation is 5,400 to 8,000 feet. The average annual precipitation is about 15 to 20 inches.

This unit is 40 percent Cloud Peak gravelly silt loam, 25 percent Eutroboralfs, and 20 percent Argiborolls. The Cloud Peak soil is in the higher lying timbered areas, the Eutroboralfs are in the lower lying timbered areas, and the Argiborolls are in the lower lying grassy parks (fig. 3). Included in this unit are small areas of soils that do not have a heavier textured subsoil and soils that have a thick, dark-colored surface layer and some areas of limestone Rock outcrop. Included areas make up about 15 percent of this unit.

The Cloud Peak soil is moderately deep and well drained. It formed in residuum derived dominantly from limestone. Typically, the surface is covered with a mat of needles and leaf litter about 2 inches thick. The surface layer is dark brown gravelly silt loam about 2 inches thick. The subsoil is brown and yellowish brown very gravelly silty clay loam about 20 inches thick. The substratum is brown very cobbly silt loam about 16 inches thick. Hard, fractured limestone is at a depth of 20 to 40 inches.

Permeability of the Cloud Peak soil is moderate. The hazard of water erosion is slight to moderate.

The average annual production of wood fiber is about 37 cubic feet per acre for Douglas-fir.

The Eutroboralfs are variable in depth and are well drained. They formed in residuum derived dominantly from sandstone or shale. No single profile is typical of these soils, but one commonly observed in the survey area has a surface that is covered with a mat of decomposing litter about 1 inch thick. The surface layer is dark reddish brown silty clay loam about 3 inches thick. The subsoil is dark red or red cobbly silty clay about 29 inches thick. Soft, red shale is at a depth of 20 to 40 inches.

The average annual production of wood fiber is about 37 cubic feet per acre for Douglas-fir.

The Argiborolls are mostly shallow and well drained. They formed in residuum or colluvium derived dominantly from shale and limestone. No single profile of these soils is typical, but one commonly observed in the survey area has a surface layer of dark brown very cobbly loam about 3 inches thick. The subsoil is dark brown and brown very cobbly clay loam about 9 inches thick. Fractured limestone is at a depth of 10 to 20 inches.

The average annual production of air-dry vegetation ranges from 1,500 to 1,800 pounds per acre.

The major limitations for producing and harvesting timber on this unit are steepness of slope and shallow soil depth in some areas. There are no major limitations for producing forage.

16—Cryaquolls, 0 to 5 percent slopes. This map unit is on flood plains and in alluvial depressional areas. The natural vegetation is mainly willows and rushes in the wetter areas of the unit and tufted hairgrass and alpine timothy in the drier areas. Elevation is 7,000 to 9,000 feet. The average annual precipitation is about 15 to 35

Figure 3.—Typical area of Cloud Peak-Eutroboralfs-Argiborolls association, 10 to 65 percent slopes. Debris avalanche in center.

inches. Many areas of these soils have a water table at or near the surface for at least part of the year and are wet for significant periods of time. These soils are subject to frequent periods of flooding in spring.

Included in this unit are small areas of Cryoborolls and Histosols.

The Cryaquolls generally are deep and somewhat poorly drained to poorly drained. They formed in alluvium. The surface layer is dark brown or very dark grayish brown loam about 15 inches thick. The substratum is dark grayish brown and dark yellowish brown gravelly and very gravelly loam and sandy clay loam that has many distinct mottles and extends to a depth of 40 inches or more.

The average annual production of air-dry vegetation ranges from 3,000 to 3,500 pounds per acre.

Frequent flooding and poor drainage are major limitations for many uses.

17—Farlow-Pishkun association, 5 to 40 percent slopes. This map unit is on old landslide deposits that are characterized by complex slopes (fig. 4). The natural vegetation is mainly big sagebrush and Idaho fescue. Elevation is 5,000 to 9,000 feet. The average annual precipitation is about 15 to 30 inches.

This unit is 45 percent Farlow gravelly loam, 30 percent Pishkun very gravelly loam, and 10 percent included areas of Starley soils. The Farlow soil is in concave areas on north- and east-facing side slopes, the

Pishkun soil is in convex areas on south- and west-facing side slopes, and the Starley soil is in convex areas on ridges. Also included in this unit are small areas of moderately deep to deep soils that have a zone of clay accumulation and some areas of soils that are warmer; these included areas make up about 15 percent of this unit.

The Farlow soil is deep and well drained. It formed in calcareous colluvium derived dominantly from limestone. The surface layer is very dark brown gravelly loam about 8 inches thick. The subsoil is dark grayish brown gravelly clay loam about 8 inches thick. The substratum is brown very gravelly clay loam about 29 inches thick. Limestone is at a depth of 40 to 60 inches.

Permeability of the Farlow soil is moderate. The hazard of water erosion is slight to moderate.

The average annual production of air-dry vegetation ranges from 1,500 to 1,800 pounds per acre.

The Pishkun soil is deep and well drained. It formed in calcareous stony colluvium derived dominantly from limestone. The surface layer is very dark grayish brown and dark grayish brown very gravelly loam about 7 inches thick. The substratum is yellowish brown extremely gravelly clay loam about 35 inches thick. Limestone is at a depth of 60 inches or more.

Permeability of the Pishkun soil is moderate. The hazard of water erosion is slight to moderate.

The average annual production of air-dry vegetation ranges from 1,200 to 1,700 pounds per acre.

Some mass movement of soil has been observed in this unit. This necessitates careful location and construction of roads. There are no major limitations for producing forage.

18—Fourmile loam, 2 to 30 percent slopes. This deep, well drained soil is on old terraces. It formed in

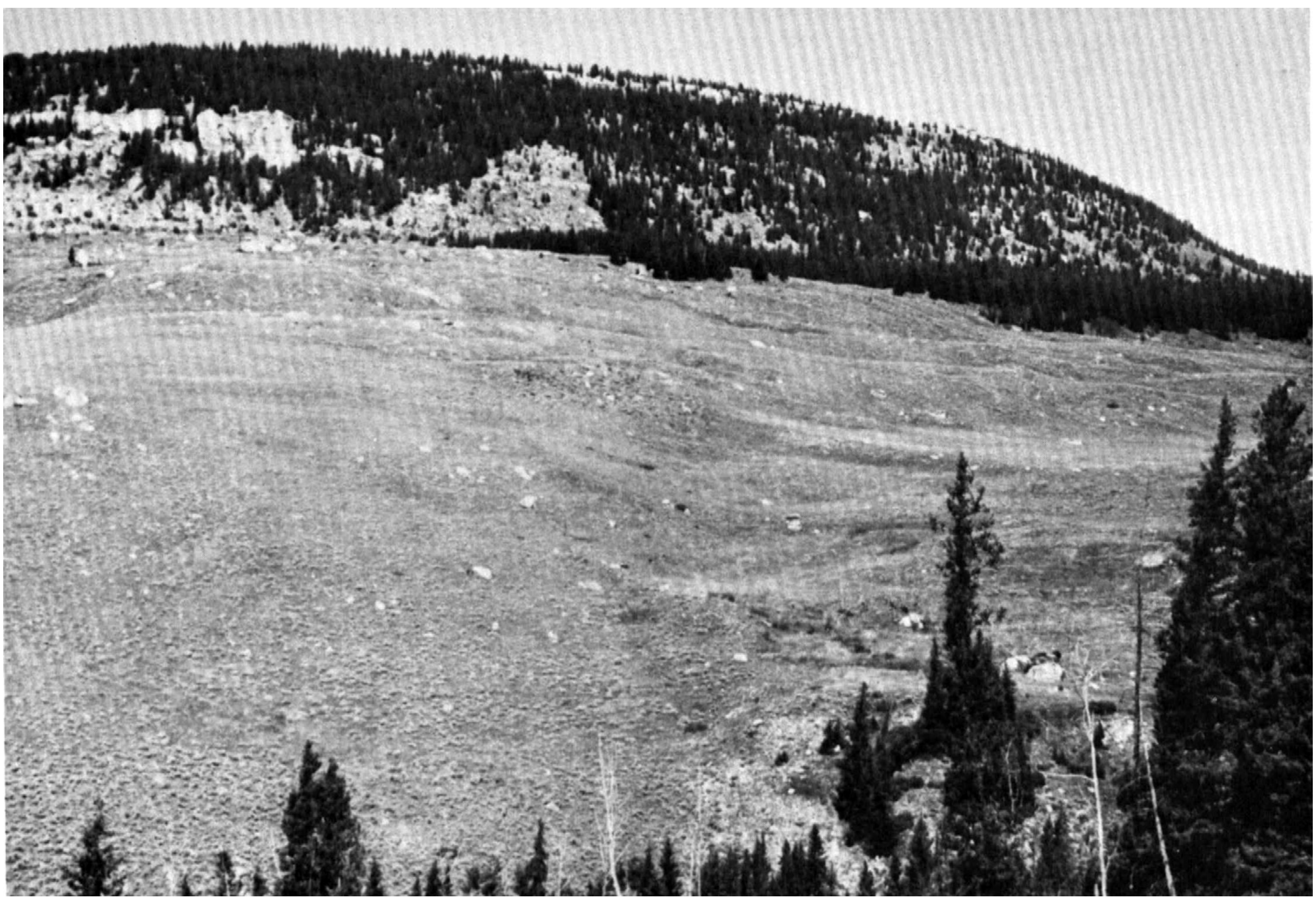


Figure 4.—Typical area of Farlow-Pishkun association, 5 to 40 percent slopes, in foreground. Area of Rock outcrop-Cloud Peak association, 10 to 70 percent slopes, in background.

Figure 5.—Typical vegetation in an area of Fourmile loam, 2 to 30 percent slopes.

alluvium derived dominantly from granite. The natural vegetation is mainly Idaho fescue and silky lupine (fig. 5). Elevation is 7,000 to 9,000 feet. The average annual precipitation is about 15 to 25 inches.

Included in this unit are small areas of Lucky, Hazton, and Burgess soils, soils that are similar to this Fourmile soil but have a thicker surface layer or a clayey subsoil, or both, and soils that are similar to this Fourmile soil but have shallow sandy substrata.

The surface layer is very dark brown and dark brown loam and gravelly loam about 10 inches thick. The subsoil is brown and dark yellowish brown very cobbly sandy clay loam about 14 inches thick. The substratum is dark yellowish brown extremely cobbly loamy coarse sand about 17 inches thick. Granite is at a depth of 60 inches or more.

Permeability of the Fourmile soil is moderate. The hazard of water erosion is slight.

The average annual production of air-dry vegetation ranges from 1,500 to 1,800 pounds per acre.

This unit has no major limitations for producing forage.

19—Frisco-Troutville association, 2 to 40 percent slopes. This map unit is on glacial moraines. Stones and boulders commonly are on the surface (fig. 6). The natural vegetation is mainly lodgepole pine and grouse whortleberry. Elevation is 7,000 to 9,000 feet. The average annual precipitation is about 15 to 30 inches.

This unit is 50 percent Frisco loam and 35 percent Troutville very stony sandy loam. The Frisco soil is in the more gently sloping areas on moraine side slopes, and the Troutville soil is on the steeper moraine side slopes. Included in this unit are small areas of soils that do not have a layer of clay accumulation, soils that do not have a subsoil, and wet soils that have a dark-colored surface layer. Included areas make up about 15 percent of this unit.

The Frisco soil is deep and well drained. It formed in glacial till derived dominantly from granite. Typically, the surface is covered with a mat of needles and twigs about 2 inches thick. The surface layer is very dark grayish brown loam about 2 inches thick. The subsurface layer is brown and dark yellowish brown cobbly and very cobbly sandy loam about 21 inches thick. The subsoil is dark yellowish brown and yellowish brown very stony sandy clay loam and sandy loam about 27 inches thick. The substratum is yellowish brown extremely stony sandy loam about 10 inches thick. Granite is at a depth of 60 inches or more.

Permeability of the Frisco soil is moderate. The hazard of water erosion is slight to moderate.

The average annual production of wood fiber is about 41 cubic feet per acre for lodgepole pine.

The Troutville soil is deep and well drained. It formed in glacial till derived dominantly from granite. Typically, the surface is covered with a mat of leaf litter about 2 inches thick. The surface layer is brown very stony sandy loam about 12 inches thick. The subsoil, about 33 inches thick, is mixed brown and yellowish brown extremely stony sandy loam containing sandy clay loam lamellae. Granite is at a depth of 60 inches or more.

Permeability of the Troutville soil is moderately rapid. The hazard of water erosion is slight to moderate.

The average annual production of wood fiber is about 28 cubic feet per acre for lodgepole pine.

The major limitations for producing and harvesting timber on this unit are stones and boulders on the surface and steepness of slope.

20—Grobutte very gravelly loam, 8 to 60 percent slopes. This deep, well drained soil is on mountainsides and old landslide deposits. It formed in colluvium derived dominantly from limestone and shale. The natural

Figure 6.—Typical area of Frisco-Troutville association, 2 to 40 percent slopes. The roadcut shows the stony characteristics of the soils.

vegetation is mainly Utah juniper and black sagebrush. Elevation is 5,000 to 7,000 feet. The average annual precipitation is about 14 to 16 inches.

Included in this unit are small areas of shallow soils, Rock outcrop, drier soils that have a subsoil, and soils that have a thicker dark-colored surface layer.

The surface layer is dark grayish brown very gravelly loam about 3 inches thick. The upper part of the substratum is brown very gravelly loam about 7 inches thick, and the lower part is pale brown extremely gravelly loam about 31 inches thick. Limestone and shale are at a depth of 60 inches or more.

Permeability of the Grobutte soil is moderate. The hazard of water erosion is slight to moderate.

The average annual production of air-dry vegetation ranges from 600 to 800 pounds per acre.

This unit has no major limitations for producing forage.

21—Hanson-Raynesford association, 0 to 30 percent slopes. This map unit is on alluvial fans, terraces, and terrace breaks. The natural vegetation is mainly Idaho fescue and silky lupine. Elevation is 6,500 to 8,200 feet. The average annual precipitation is about 18 to 30 inches.

This unit is 45 percent Hanson very cobbly loam and 40 percent Raynesford loam. The Hanson soil is on alluvial fans, terraces, and terrace breaks, and the Raynesford soil is in level to gently sloping areas on terraces and fans. Included in this unit are small areas of Rock outcrop, Nathrop and Passcreek soils, soils that do not have a layer of calcium carbonate, and clayey soils near terrace breaks. Included areas make up about 15 percent of this unit.

The Hanson soil is deep and well drained. It formed in calcareous alluvium derived dominantly from limestone. The surface layer is very dark grayish brown very cobbly loam about 12 inches thick. The upper part of the substratum is brown very cobbly loam about 9 inches thick, and the lower part is light gray very cobbly loam about 19 inches thick. Limestone is at a depth of 60 inches or more.

Permeability of the Hanson soil is moderate. The hazard of water erosion is slight.

The average annual production of air-dry vegetation ranges from 1,500 to 1,800 pounds per acre.

The Raynesford soil is deep and well drained. It formed in calcareous alluvium derived dominantly from limestone. The surface layer is very dark brown loam about 12 inches thick. The upper part of the substratum is brown loam about 9 inches thick, and the lower part is very pale brown gravelly loam and very cobbly loam about 20 inches thick. Limestone is at a depth of 60 inches or more.

Permeability of the Raynesford soil is moderately slow. The hazard of water erosion is slight.

The average annual production of air-dry vegetation ranges from 1,500 to 1,800 pounds per acre.

This unit has no major limitations for producing forage.

22—Hanson Variant-Starley association, 10 to 60 percent slopes. This map unit is on mountainsides that predominantly have south aspects. The natural vegetation is mainly Idaho fescue and bluebunch wheatgrass on the Hanson Variant soil and Idaho fescue and sedges on the Starley soil. Limber pine and ponderosa pine are very widely spaced on the Hanson Variant soil, and their basal area is low. Elevation is 5,400 to 7,000 feet. The average annual precipitation is about 16 to 25 inches.

This unit is 50 percent Hanson Variant very gravelly silt loam, 25 percent Starley loam, and 10 percent included areas of Rock outcrop. The Hanson Variant soil is in moderately sloping areas, the Starley soil is in steeply sloping areas near Rock outcrop, and Rock outcrop is on ridges and small escarpments. Also included in this unit are small areas of soils that are similar to the Hanson Variant and Starley soils but have a light-colored surface layer, reddish soils near upper slope breaks, and some warmer soils at the lower elevations; these included areas make up about 15 percent of this unit.

The Hanson Variant soil is moderately deep and well drained. It formed in colluvium derived dominantly from limestone. The surface layer is very dark grayish brown very gravelly silt loam about 9 inches thick. The substratum is dark brown and brown very gravelly loam about 15 inches thick. Fractured limestone is at a depth of 20 to 40 inches.

Permeability of the Hanson Variant soil is moderate. The hazard of water erosion is slight to moderate.

The average annual production of air-dry vegetation ranges from 1,200 to 1,700 pounds per acre.

The Starley soil is shallow and well drained. It formed in residuum or colluvium derived dominantly from limestone. The surface layer is very dark grayish brown loam about 8 inches thick. The substratum is brown extremely cobbly loam about 7 inches thick. Fractured limestone is at a depth of 7 to 20 inches.

Permeability of the Starley soil is moderate. The hazard of water erosion is slight to moderate.

The average annual production of air-dry vegetation ranges from 1,200 to 1,700 pounds per acre.

The major limitation for producing forage on this unit is droughtiness of the Starley soil.

23—Inchau-Carbol association, 2 to 20 percent slopes. This map unit is on mountainsides, fans, and ridges. The natural vegetation is mainly Idaho fescue and sedges. Elevation is 9,000 to 9,300 feet. The average annual precipitation is about 25 to 30 inches.

This unit is 50 percent Inchau loam and 35 percent Carbol loam. The Inchau soil is in gently sloping areas on mountainsides and fans, and the Carbol soil is on ridges and on the steeper side slopes. Included in this

unit are small areas of moderately deep and shallow soils that do not have a zone of clay accumulation, some areas of sandstone Rock outcrop, and soils that are similar to this Inchau soil but have a thicker surface layer. Included areas make up about 15 percent of this unit.

The Inchau soil is moderately deep and well drained. It formed in residuum or alluvium derived dominantly from sandstone. The surface layer is very dark grayish brown loam about 7 inches thick. The subsoil is dark yellowish brown and yellowish brown clay loam about 13 inches thick. The substratum is light olive brown gravelly clay loam about 8 inches thick. Soft sandstone is at a depth of 20 to 40 inches.

Permeability of the Inchau soil is moderately slow. The hazard of water erosion is slight.

The average annual production of air-dry vegetation ranges from 1,500 to 1,800 pounds per acre.

The Carbol soil is shallow and well drained. It formed in residuum derived dominantly from hard sandstone. The surface layer is very dark grayish brown loam about 3 inches thick. The upper part of the subsoil is very dark grayish brown loam about 3 inches thick, and the lower part is brown gravelly sandy clay loam about 6 inches thick. Hard sandstone is at a depth of 10 to 20 inches.

Permeability of the Carbol soil is moderate. The hazard of water erosion is slight.

The average annual production of air-dry vegetation ranges from 600 to 800 pounds per acre.

The major limitation for producing forage on this unit is droughtiness of the Carbol soil.

24—Leavitt-Passcreek association, 2 to 30 percent slopes. This map unit is on mountainsides, toe slopes, and fans. The natural vegetation is mainly Idaho fescue and silky lupine. Elevation is 7,000 to 8,500 feet. The average annual precipitation is about 15 to 35 inches.

This unit is 40 percent Leavitt loam, 35 percent Passcreek loam, and 10 percent included areas of Nathrop soils. The Leavitt soil is on toe slopes and fans, the Passcreek soil is on fans and mountainsides, and the Nathrop soils are on mountainsides. Also included in this unit are small areas of Starley soils, Rock outcrop, reddish clayey soils that are similar to the Passcreek soil, and soils that are similar to the Leavitt soil but have a thicker dark-colored surface layer; these included areas make up about 15 percent of this unit.

The Leavitt soil is deep and well drained. It formed in alluvium or colluvium derived dominantly from limestone. The surface layer is very dark brown loam over silt loam about 12 inches thick. The upper part of the subsoil is dark brown silty clay loam about 13 inches thick. The lower part of the subsoil and the substratum are brown gravelly silty clay loam about 19 inches thick. Limestone is at a depth of 60 inches or more.

Permeability of the Leavitt soil is moderately slow. The hazard of water erosion is moderate to severe.

The average annual production of air-dry vegetation ranges from 1,600 to 2,400 pounds per acre.

The Passcreek soil is moderately deep and well drained. It formed in residuum or alluvium derived dominantly from limestone. The surface layer is very dark brown loam about 7 inches thick. The subsoil is dark yellowish brown and brown clay loam and gravelly clay loam about 12 inches thick. The substratum is brown very gravelly loam about 11 inches thick. Limestone is at a depth of 20 to 40 inches.

Permeability of the Passcreek soil is moderate. The hazard of water erosion is slight to moderate.

The average annual production of air-dry vegetation ranges from 1,600 to 2,400 pounds per acre.

The hazard of erosion on the Leavitt soil requires careful grazing management on this unit.

25—Lucky-Burgess-Hazton association, 2 to 30 percent slopes. This map unit is on mountainsides and ridges. The natural vegetation is mainly Idaho fescue and sedges (fig. 7). Elevation is 7,000 to 9,000 feet. The average annual precipitation is about 15 to 30 inches.

This unit is 35 percent Lucky gravelly loam, 30 percent Burgess loam, and 20 percent Hazton gravelly sandy loam. The Lucky and Burgess soils are in gently sloping areas, and the Hazton soil is in the more steeply sloping areas and on ridges. Included in this unit are small areas of granitic Rock outcrop, wet soils in seeps, and soils that are similar to the Hazton soil but have more gravel. Included areas make up about 15 percent of this unit.

The Lucky soil is moderately deep and well drained. It formed in residuum derived dominantly from granite. The surface layer is very dark grayish brown gravelly loam about 7 inches thick. The subsoil is dark brown and brown gravelly sandy loam and gravelly sandy clay loam about 13 inches thick. The substratum is dark yellowish brown very gravelly coarse sandy loam about 10 inches thick. Hard granite is at a depth of 20 to 40 inches.

Permeability of the Lucky soil is moderate. The hazard of water erosion is slight.

The average annual production of air-dry vegetation ranges from 1,500 to 1,800 pounds per acre.

The Burgess soil is moderately deep and well drained. It formed in residuum derived dominantly from granite. The surface layer is very dark brown loam about 3 inches thick. The subsoil and the upper part of the substratum are dark brown and brown gravelly sandy loam about 22 inches thick, and the lower part of the substratum is yellowish brown very gravelly loamy sand about 4 inches thick. Hard, fractured granite is at a depth of 20 to 40 inches.

Permeability of the Burgess soil is moderate. The hazard of water erosion is slight.

The average annual production of air-dry vegetation ranges from 1,500 to 1,800 pounds per acre.

The Hazton soil is shallow and well drained. It formed in residuum derived dominantly from granite. The surface

Figure 7.—Typical area of Lucky-Burgess-Hazton association, 2 to 30 percent slopes.

layer is very dark grayish brown gravelly sandy loam about 7 inches thick. The substratum is dark yellowish brown gravelly coarse sandy loam about 6 inches thick. Hard granite is at a depth of 10 to 20 inches.

Permeability of the Hazton soil is moderately rapid. The hazard of water erosion is slight.

The average annual production of air-dry vegetation ranges from 600 to 800 pounds per acre.

The major limitation for producing forage on this unit is droughtiness of the Hazton soil.

26—Mirror-Teewinot-Bross association, 2 to 40 percent slopes. This map unit is on mountainsides, ridges, and moraines. The natural vegetation is mainly an alpine community (fig. 8). Elevation is 9,500 to 11,000 feet. The average annual precipitation is about 28 to 35 inches.

This unit is 40 percent Mirror cobbly loam, 25 percent Teewinot very cobbly loam, and 20 percent Bross gravelly loam. The Mirror soil is on mountainsides and toe slopes, the Teewinot soil is on mountainsides and ridges, and the Bross soil is on mountainsides and moraines. Included in this unit are small areas of Rubble land, shallow to deep soils that have a light-colored surface layer, and wet soils in meadows or bogs. Included areas make up about 15 percent of this unit.

The Mirror soil is moderately deep and well drained. It formed in colluvium or residuum derived dominantly from granite. The surface layer is very dark grayish brown cobbly loam about 10 inches thick. The subsoil is dark yellowish brown and yellowish brown very cobbly loam about 23 inches thick. Hard, fractured granite is at a depth of 20 to 40 inches.

Permeability of the Mirror soil is moderate. The hazard of water erosion is slight.

The average annual production of air-dry vegetation ranges from 600 to 800 pounds per acre.

The Teewinot soil is shallow and well drained. It formed in residuum derived dominantly from granite. The surface layer is very dark grayish brown very cobbly loam about 8 inches thick. The subsoil is dark yellowish brown very cobbly loam about 9 inches thick. Hard granite is at a depth of 10 to 20 inches.

Permeability of the Teewinot soil is moderately rapid. The hazard of water erosion is slight to moderate.

The average annual production of air-dry vegetation ranges from 600 to 800 pounds per acre.

The Bross soil is deep and well drained. It formed in glacial till or residuum derived dominantly from granite. The surface layer is very dark brown gravelly loam about 2 inches thick. The subsurface layer is very dark grayish brown very cobbly loam about 8 inches thick. The subsoil is dark yellowish brown very cobbly loam about 17 inches thick. The substratum is dark yellowish brown very cobbly sandy loam and gravelly sandy loam about 13 inches thick. Granite is at a depth of 60 inches or more.

Permeability of the Bross soil is moderate. The hazard of water erosion is slight.

The average annual production of air-dry vegetation ranges from 1,200 to 1,700 pounds per acre.

The major limitations for producing forage on this unit are the cold alpine climate and short growing season.

27—Nathrop-Passcreek-Starley association, 2 to 30 percent slopes. This map unit is on mountainsides, ridges, and fans. The natural vegetation is mainly Idaho fescue and silky lupine on the Nathrop and Passcreek soils and Idaho fescue and sedges on the Starley soil. Elevation is 5,500 to 9,000 feet. The average annual precipitation is about 15 to 30 inches.

This unit is 30 percent Nathrop loam, 30 percent Passcreek loam, and 25 percent Starley loam. The Nathrop soil is on the upper part of mountainsides, the Passcreek soil is on foot slopes and fans, and the Starley is on the upper part of mountainsides and on ridges. Included in this unit are small areas of limestone Rock outcrop and Starman, Leavitt, and Echemoor soils. Included areas make up about 15 percent of this unit.

The Nathrop soil is moderately deep and well drained. It formed in residuum derived dominantly from limestone. The surface layer is very dark brown loam about 8

Figure 8.—Typical area of Mirror-Teewinot-Bross association, 2 to 40 percent slopes in foreground; Rock outcrop-Teewinot-Agneston association, 5 to 35 percent slopes, in valley in center; and Rubble land, 5 to 50 percent slopes, in background.

inches thick. The upper part of the subsoil is dark brown very cobbly clay loam about 6 inches thick, and the lower part of the subsoil and the substratum are dark yellowish brown and yellowish brown very cobbly clay loam about 24 inches thick. Fractured limestone is at a depth of 20 to 40 inches.

Permeability of the Nathrop soil is moderate. The hazard of water erosion is slight.

The average annual production of air-dry vegetation ranges from 1,600 to 2,400 pounds per acre.

The Passcreek soil is moderately deep and well drained. It formed in residuum or alluvium derived dominantly from limestone. The surface layer is very dark brown loam about 7 inches thick. The subsoil is dark yellowish brown and brown clay loam and gravelly clay loam about 12 inches thick. The substratum is brown very gravelly loam about 11 inches thick. Limestone is at a depth of 20 to 40 inches.

Permeability of the Passcreek soil is moderate. The hazard of water erosion is slight to moderate.

The average annual production of air-dry vegetation ranges from 1,600 to 2,400 pounds per acre.

The Starley soil is shallow and well drained. It formed in residuum or colluvium derived dominantly from limestone. The surface layer is very dark grayish brown loam about 8 inches thick. The substratum is brown extremely cobbly loam about 7 inches thick. Fractured limestone is at a depth of 7 to 20 inches.

Permeability of the Starley soil is moderate. The hazard of water erosion is slight to moderate.

The average annual production of air-dry vegetation ranges from 1,200 to 1,700 pounds per acre.

The major limitation for producing forage on this unit is droughtiness of the Starley soil.

28—Nathrop Variant-Nielsen-Passcreek association, 2 to 35 percent slopes. This map unit is on mountainsides, toe slopes, and fans. The natural vegetation is mainly Idaho fescue and silky lupine. Elevation is 7,200 to 8,200 feet. The average annual precipitation is about 15 to 30 inches.

This unit is 35 percent Nathrop Variant channery very fine sandy loam, 30 percent Nielsen channery loam, and 20 percent Passcreek loam. The Nathrop Variant soil is in gently sloping areas on mountainsides and toe slopes, the Nielsen soil is in convex areas on ridges and on the steeper side slopes, and the Passcreek soil is on toe slopes and fans. Included in this unit are small areas of reddish soils, soils that have a thicker dark-colored surface layer, and shallow, light-colored soils on ridgetops. Included areas make up about 15 percent of this unit.

The Nathrop Variant soil is moderately deep and well drained. It formed in residuum derived dominantly from sandstone. The surface layer is very dark brown channery very fine sandy loam about 7 inches thick. The subsoil is brown and yellowish brown very channery fine sandy clay loam about 15 inches thick. Interbedded calcareous and noncalcareous sandstone are at a depth of 20 to 40 inches.

Permeability of the Nathrop Variant soil is moderately slow. The hazard of water erosion is slight.

The average annual production of air-dry vegetation ranges from 1,200 to 1,700 pounds per acre.

The Nielsen soil is shallow and well drained. It formed in residuum derived dominantly from calcareous sandstone. The surface layer is very dark grayish brown and dark brown channery loam about 10 inches thick. The subsoil is dark grayish brown very channery clay loam about 8 inches thick. Calcareous sandstone is at a depth of 10 to 20 inches.

Permeability of the Nielsen soil is moderately slow. The hazard of water erosion is slight.

The average annual production of air-dry vegetation ranges from 1,200 to 1,700 pounds per acre.

The Passcreek soil is moderately deep and well drained. It formed in residuum or alluvium derived dominantly from limestone. The surface layer is very dark brown loam about 7 inches thick. The subsoil is dark yellowish brown and brown clay loam and gravelly clay loam about 12 inches thick. The substratum is brown very gravelly loam about 11 inches thick. Limestone is at a depth of 20 to 40 inches.

Permeability of the Passcreek soil is moderate. The hazard of water erosion is slight to moderate.

The average annual production of air-dry vegetation ranges from 1,600 to 2,400 pounds per acre.

The major limitation for producing forage on this unit is droughtiness of the Nathrop Variant and Nielsen soils.

29—Owen Creek-Echemoor-Bynum association, 2 to 30 percent slopes. This map unit is on mountainsides, toe slopes, and fans. The natural vegetation is mainly big sagebrush and Idaho fescue (fig. 9). Elevation is 7,000 to 9,200 feet. The average annual precipitation is about 15 to 30 inches.

This unit is 40 percent Owen Creek clay loam, 25 percent Echemoor silt loam, and 20 percent Bynum silty clay loam. The Owen Creek soil is on mountainsides, the Echemoor soil is on toe slopes and fans, and the Bynum soil is on mountainsides and ridges. Included in this unit are small areas of Starman, Nathrop, and Inchau soils, Rock outcrop, a soil that is similar to the Echemoor soil but is deep, and a soil that is similar to the Owen Creek soil but is redder. Included areas make up about 15 percent of this unit.

The Owen Creek soil is moderately deep and well drained. It formed in colluvium derived dominantly from interbedded shale and limestone. The surface layer is very dark gray clay loam about 4 inches thick. The subsoil is dark olive gray and olive gray clay about 13 inches thick. The substratum is gray channery clay about 7 inches thick. Interbedded shale and limestone are at a depth of 20 to 40 inches.

Figure 9.—Typical areas of Owen Creek-Echemoor-Bynum association, 2 to 30 percent slopes, in foreground and background; area of Cryaquolls, 0 to 5 percent slopes, on valley bottom in center.

Permeability of the Owen Creek soil is slow. The hazard of water erosion is slight to moderate.

The average annual production of air-dry vegetation ranges from 1,600 to 2,400 pounds per acre.

The Echemoor soil is moderately deep and well drained. It formed in residuum or alluvium derived dominantly from calcareous shale and limestone. The surface layer is very dark brown silt loam about 14 inches thick. The subsoil is dark brown and light olive brown silty clay loam about 19 inches thick. Soft shale is at a depth of 20 to 40 inches.

Permeability of the Echemoor soil is moderate. The hazard of erosion is slight.

The average annual production of air-dry vegetation ranges from 3,000 to 3,500 pounds per acre.

The Bynum soil is moderately deep and well drained. It formed in residuum derived dominantly from interbedded shale and sandstone. The surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 4 inches thick. The subsoil is olive channery clay loam about 6 inches thick. The substratum is grayish brown channery clay loam about 10 inches thick. Soft, calcareous shale is at a depth of 20 to 40 inches.

Permeability of the Bynum soil is moderate. The hazard of water erosion is slight.

The average annual production of air-dry vegetation ranges from 1,600 to 2,400 pounds per acre.

This unit has no major limitations for producing forage. Mass movement of soil is common in this unit. This necessitates careful road location and construction. High shrink-swell potential is also a major limitation for road construction on the Owen Creek soil.

30—Owen Creek-Waybe association, 5 to 35 percent slopes. This map unit is on moderately stable

to unstable landslide deposits. The natural vegetation is mainly big sagebrush and Idaho fescue (fig. 10). Elevation is 5,600 to 9,500 feet. The average annual precipitation is about 15 to 35 inches.

This unit is 40 percent Owen Creek clay loam, 35 percent Waybe channery clay, and 10 percent included areas of shallow, clayey soils. The Owen Creek soil is in the more gently sloping areas, the Waybe soil is in the more steeply sloping areas and on escarpments, and the shallow, clayey soils are in the more steeply sloping areas near shale outcrops. Also included in this unit are small areas of Starman and Starley soils, wet soils in seeps and drainageways, and active landslides characterized by exposed shale outcrops and interbedded limestone; these included areas make up about 15 percent of this unit.

The Owen Creek soil is moderately deep and well drained. It formed in colluvium derived dominantly from interbedded shale and limestone. The surface layer is very dark gray clay loam about 4 inches thick. The subsoil is dark olive gray and olive gray clay about 13 inches thick. The substratum is gray channery clay about 7 inches thick. Interbedded shale and limestone are at a depth of 20 to 40 inches.

Permeability of the Owen Creek soil is slow. The hazard of water erosion is slight to moderate.

The average annual production of air-dry vegetation ranges from 1,600 to 2,400 pounds per acre.

The Waybe soil is shallow and well drained. It formed in colluvium derived dominantly from interbedded shale and limestone. The surface layer is olive gray channery clay about 3 inches thick. The substratum is olive gray clay about 13 inches thick. Weathered shale is at a depth of 10 to 20 inches.

Permeability of the Waybe soil is slow. The hazard of water erosion is moderate to severe.

Figure 10.—Typical area of Owen Creek-Waybe association, 5 to 35 percent slopes. Timbered areas are Tongue River-Gateway association, 2 to 35 percent slopes.

The average annual production of air-dry vegetation ranges from 600 to 800 pounds per acre.

Mass movement of soil occurs frequently in areas of this unit. This necessitates careful road location and construction. High shrink-swell potential is also a major limitation for road construction. The major limitation for producing forage is droughtiness of the Waybe soil. The hazard of erosion on the Waybe soil also necessitates careful grazing management on this unit.

31—Rock outcrop-Agneston-Rubble land association, 5 to 60 percent slopes. This map unit is on mountainsides, escarpments, and canyon walls. The natural vegetation is mainly lodgepole pine and grouse whortleberry. Elevation is 6,500 to 9,500 feet. The average annual precipitation is about 20 to 30 inches.

This unit is 35 percent Rock outcrop, 30 percent Agneston sandy loam, and 20 percent Rubble land. The Rock outcrop is on the steeper side slopes, escarpments, and canyon walls, the Agneston soil is on mountainsides, and the Rubble land is on talus slopes below escarpments. Included in this unit are small areas of Granile soils and shallow soils that are similar to the Agneston soil but do not have a clayey subsoil. Included areas make up about 15 percent of this unit.

Rock outcrop occurs throughout the unit as exposures of granite.

The Agneston soil is moderately deep and well drained. It formed in residuum derived dominantly from granite. Typically, the surface is covered with a mat of mosses and litter about 1 inch thick. The surface layer is very dark grayish brown sandy loam about 2 inches thick. The subsurface layer is brown gravelly coarse sandy loam about 5 inches thick. The upper part of the subsoil is dark yellowish brown very cobbly sandy clay loam about 15 inches thick, and the lower part is dark brown very cobbly fine sandy loam about 6 inches thick. Fractured granite is at a depth of 20 to 40 inches.

Permeability of the Agneston soil is moderately slow. The hazard of water erosion is slight to moderate.

The average annual production of wood fiber is about 27 cubic feet per acre for lodgepole pine.

Rubble land occurs as granitic talus.

The major limitations for producing and harvesting timber on this unit are steepness of slope and the areas of Rock outcrop and Rubble land.

32—Rock outcrop-Cloud Peak association, 10 to 70 percent slopes. This map unit is on limestone escarpments and colluvial side slopes. The natural vegetation is mainly Douglas-fir and mountain ninebark (fig. 11). Elevation is 5,000 to 9,500 feet. The average annual precipitation is about 16 to 35 inches.

This unit is 55 percent Rock outcrop and 30 percent Cloud Peak gravelly silt loam. The Rock outcrop is on steep escarpments, and the Cloud Peak soil is on colluvial side slopes. Included in this unit are small areas of soils that are similar to the Cloud Peak soil but do not have a clayey subsoil, young soils that have little horizonation, and soils that are similar to the Cloud Peak soil but have a darker colored, thicker surface layer. Included areas make up about 15 percent of this unit.

Rock outcrop occurs throughout the unit as limestone escarpments.

The Cloud Peak soil is moderately deep and well drained. It formed in colluvium derived dominantly from limestone. Typically, the surface is covered with a mat of needles and leaf litter about 2 inches thick. The surface layer is dark brown gravelly silt loam about 2 inches thick. The subsoil is brown and yellowish brown very gravelly silty clay loam about 20 inches thick. The substratum is brown very cobbly silt loam about 16 inches thick. Hard, fractured limestone is at a depth of 20 to 40 inches.

Permeability of the Cloud Peak soil is moderate. The hazard of water erosion is slight to moderate.

The average annual production of wood fiber is about 37 cubic feet per acre for Douglas-fir.

The major limitations for producing and harvesting timber on this unit are steepness of slope and the areas of Rock outcrop.

33—Rock outcrop-Mirror-Teewinot association, 5 to 35 percent slopes. This map unit is on mountainsides, ridges, and peaks. The natural vegetation is mainly an alpine plant community. Elevation is 9,200 to 11,000 feet. The average annual precipitation is about 28 to 35 inches.

This unit is 40 percent Rock outcrop, 25 percent Mirror cobbly loam, and 20 percent Teewinot very cobbly loam. The Rock outcrop is on ridges and peaks, the Mirror soil is in saddles and basins between areas of Rock outcrop, and the Teewinot soil is in the saddles and basins closer to the areas of Rock outcrop. Included in this unit are small areas of soils that have a light-colored surface layer, wet soils, Rubble land, and shallow to deep soils that do not have a high content of cobbles. Included areas make up about 15 percent of this unit.

Rock outcrop occurs throughout the unit as exposures of granite.

The Mirror soil is moderately deep and well drained. It formed in colluvium or residuum derived dominantly from granite. The surface layer is very dark grayish brown cobbly loam about 10 inches thick. The subsoil is dark yellowish brown and yellowish brown very cobbly loam about 23 inches thick. Fractured granite is at a depth of 20 to 40 inches.

Permeability of the Mirror soil is moderate. The hazard of water erosion is slight.

The average annual production of air-dry vegetation ranges from 600 to 800 pounds per acre.

The Teewinot soil is shallow and well drained. It formed in residuum derived dominantly from granite. The surface layer is very dark grayish brown very cobbly

Figure 11.—Area of Rock outcrop-Cloud Peak association, 10 to 70 percent slopes.

loam about 8 inches thick. The subsoil is dark yellowish brown very cobbly loam about 9 inches thick. Granite is at a depth of 10 to 20 inches.

Permeability of the Teewinot soil is moderately rapid. The hazard of water erosion is slight to moderate.

The average annual production of air-dry vegetation ranges from 600 to 800 pounds per acre.

The major limitations for producing forage on this unit are the cold alpine climate and short growing season.

34—Rock outcrop-Starman association, 5 to 70 percent slopes. This map unit is on back slopes, escarpments, and canyon walls. The natural vegetation is mainly Idaho fescue and sedges. Elevation is 5,500 to 9,000 feet. The average annual precipitation is about 20 to 35 inches.

This unit is 55 percent Rock outcrop and 30 percent Starman channery clay loam. The Rock outcrop is on escarpments and canyon walls, and the Starman soil is on back slopes. Included in this unit are small areas of Starley and Nathrop soils. Included areas make up about 15 percent of this unit.

Rock outcrop occurs throughout the unit as exposures of limestone.

The Starman soil is shallow and well drained. It formed in residuum derived dominantly from limestone. The surface layer is dark grayish brown channery clay loam about 3 inches thick. The substratum is grayish brown extremely channery clay loam about 12 inches thick. Fractured limestone is at a depth of 10 to 20 inches.

Permeability of the Starman soil is moderately slow. The hazard of water erosion is slight to moderate.

The average annual production of air-dry vegetation ranges from 600 to 800 pounds per acre.

The major limitation for producing forage on this unit is droughtiness of the Starman soil.

35—Rock outcrop-Starman Variant association, 10 to 70 percent slopes. This map unit is on escarpments and back slopes. The natural vegetation is mainly mountainmahogany and bluebunch wheatgrass. Elevation is 4,600 to 6,500 feet. The average annual precipitation is about 14 to 16 inches.

This unit is 45 percent Rock outcrop, 35 percent Starman Variant very channery loam, and 10 percent included areas of Rubble land. The Rock outcrop is on escarpments, the Starman Variant soil is on back slopes, and Rubble land is below escarpments. Also included in this unit are small areas of moderately deep and deep soils that are similar to the Starman Variant soil and are on colluvial toe slopes and areas of reddish brown soils derived from sandstone and shale; these included areas make up about 10 percent of this unit.

Rock outcrop occurs throughout the unit as limestone escarpments.

The Starman Variant soil is shallow and well drained. It formed in residuum derived dominantly from limestone. The surface layer is brown very channery loam about 2 inches thick. The substratum is brown extremely channery loam about 9 inches thick. Limestone is at a depth of 10 to 20 inches.

Permeability of the Starman Variant soil is moderate. The hazard of water erosion is slight to moderate.

The average annual production of air-dry vegetation ranges from 600 to 800 pounds per acre.

The major limitation for producing forage on this unit is droughtiness of the Starman Variant soil.

36—Rock outcrop-Teewinot-Agneston association, 5 to 35 percent slopes. This map unit is in glacial trough valleys and on mountainsides. The natural vegetation is mainly an alpine plant community on the Teewinot soil and Engelmann spruce and grouse whortleberry on the Agneston soil (fig. 12). Elevation is 9,000 to 11,000 feet. The average annual precipitation is about 25 to 35 inches.

This unit is 40 percent Rock outcrop, 25 percent Teewinot very cobbly loam, and 20 percent Agneston sandy loam. The Rock outcrop is in convex areas on ridges, breaks, and side slopes, the Teewinot soil is on grassy side slopes, and the Agneston soil is on forested side slopes. Included in this unit are small areas of light-colored soils that are similar to the Teewinot soil and are on ridgetops, Mirror soils, wet soils in bogs and meadows, and talus and glacial debris. Included areas make up about 15 percent of this unit.

Rock outcrop occurs throughout the unit as exposures of glacially scoured granite.

The Teewinot soil is shallow and well drained. It formed in residuum derived dominantly from granite. The surface layer is very dark grayish brown very cobbly loam about 8 inches thick. The subsoil is dark yellowish brown very cobbly loam about 9 inches thick. Hard granite is at a depth of 10 to 20 inches.

Permeability of the Teewinot soil is moderately rapid. The hazard of water erosion is slight to moderate.

The average annual production of air-dry vegetation ranges from 600 to 800 pounds per acre.

The Agneston soil is moderately deep and well drained. It formed in residuum derived dominantly from granite. Typically, the surface is covered with a mat of mosses and litter about 1 inch thick. The surface layer is very dark grayish brown sandy loam about 2 inches thick. The subsurface layer is brown gravelly coarse sandy loam about 5 inches thick. The upper part of the subsoil is dark yellowish brown very cobbly sandy clay loam about 15 inches thick, and the lower part is dark brown very cobbly fine sandy loam about 6 inches thick. Fractured granite is at a depth of 20 to 40 inches.

Permeability of the Agneston soil is moderately slow. The hazard of water erosion is slight to moderate.

The average annual production of wood fiber is about 36 cubic feet per acre for Engelmann spruce.

The major limitation for producing forage on this unit is the short growing season on the Teewinot soil. Rock outcrop is the major limitation for producing and harvesting timber on the Agneston soil.

37—Rubble land, 5 to 50 percent slopes. This map unit consists of periglacial rubble or felsenmeer on unglaciated side slopes and summits above the timberline. It supports little if any vegetation except mosses and lichens. Elevation ranges from 9,600 to 13,000 feet. The average annual precipitation is about 30 to 40 inches.

Included in this unit are small areas of Mirror and Teewinot soils, soils that support grasses, sedges, and stunted spruce or fir trees, and wet soils that support alpine willow vegetation.

Steepness of slope and the harsh alpine environment limit this unit for most uses.

38—Sapphire-Bottle-Foxton association, 2 to 35 percent slopes. This map unit is on mountainsides. The natural vegetation is mainly lodgepole pine and grouse whortleberry. Elevation is 6,500 to 8,500 feet. The average annual precipitation is about 20 to 30 inches.

This unit is 35 percent Sapphire fine sandy loam, 30 percent Bottle sandy loam, and 20 percent Foxton loam. The Sapphire and Bottle soils are in the steeper areas on side slopes, and the Foxton soil is in the more gently sloping areas. Included in this unit are small areas of Cloud Peak soils, Rock outcrop, soils that are similar to the Sapphire soil but have a thicker dark-colored surface layer, and soils that are similar to the Bottle soil but are shallow and are in convex areas on sandstone ridges. Included areas make up about 15 percent of this unit.

The Sapphire soil is moderately deep and well drained. It formed in residuum derived dominantly from sandstone. Typically, the surface is covered with a mat of leaf and twig litter about 1 inch thick. The surface

Figure 12.—Area of Rock outcrop-Teewinot-Agneston association, 5 to 35 percent slopes.

layer is brown and yellowish brown fine sandy loam about 13 inches thick. The subsoil is yellowish brown and dark yellowish brown sandy clay loam about 18 inches thick. Sandstone is at a depth of 20 to 40 inches.

Permeability of the Sapphire soil is moderate. The hazard of water erosion is slight.

The average annual production of wood fiber is about 53 cubic feet per acre for lodgepole pine.

The Bottle soil is moderately deep and is well drained to excessively drained. It formed in residuum derived dominantly from sandstone. Typically, the surface is covered with a mat of partly decomposed twigs and needles about 3 inches thick. The surface layer is dark brown sandy loam about 4 inches thick. The subsurface layer is brown fine sandy loam about 4 inches thick. The subsoil is yellowish brown gravelly fine sandy loam about 7 inches thick. The substratum is yellowish brown very gravelly sand about 12 inches thick. Sandstone is at a depth of 20 to 40 inches.

Permeability of the Bottle soil is rapid to moderately rapid. The hazard of water erosion is slight.

The average annual production of wood fiber is about 32 cubic feet per acre for lodgepole pine.

The Foxton soil is moderately deep and well drained. It formed in residuum derived dominantly from interbedded shale, limestone, and sandstone. Typically, the surface is covered with a mat of decomposed litter about 3 inches thick. The surface layer is dark grayish brown loam about 5 inches thick. The upper part of the subsoil is reddish brown clay about 8 inches thick, and the lower part is reddish brown cobbly clay about 13 inches thick. Interbedded sandstone, shale, and limestone are at a depth of 20 to 40 inches.

Permeability of the Foxton soil is slow. The hazard of water erosion is slight.

The average annual production of wood fiber is about 35 cubic feet per acre for lodgepole pine.

The major limitations for producing and harvesting timber on this unit are droughtiness of the Bottle soil and high shrink-swell potential of the Foxton soil.

39—Starman-Starley association, 2 to 30 percent slopes. This map unit is on mountainsides and ridges. The natural vegetation is mainly Idaho fescue and sedges. Elevation is 8,000 to 10,500 feet. The average annual precipitation is about 20 to 38 inches.

This unit is 40 percent Starman channery clay loam, 35 percent Starley loam, and 10 percent included areas of Rock outcrop. The Starman soil is in the steeper areas on side slopes and ridges, the Starley soil is in the more gently sloping areas, and the Rock outcrop is on ridges. Also included in this unit are small areas of Nathrop and Passcreek soils in swales and on toe slopes and small areas of fragmental talus below limestone ledges; these included areas make up about 15 percent of the unit.

The Starman soil is shallow and well drained. It formed in residuum derived dominantly from limestone. Typically, 10 to 50 percent of the surface is covered with limestone rock fragments. The surface layer is dark grayish brown channery clay loam about 3 inches thick. The substratum is grayish brown extremely channery clay loam about 12 inches thick. Fractured limestone is at a depth of 10 to 20 inches.

Permeability of the Starman soil is moderately slow. The hazard of water erosion is slight to moderate.

The average annual production of air-dry vegetation ranges from 600 to 800 pounds per acre.

The Starley soil is shallow and well drained. It formed in residuum and colluvium derived dominantly from limestone. Typically, l0 to 50 percent of the surface is covered with limestone rock fragments. The surface layer is very dark grayish brown loam about 8 inches thick. The substratum is brown extremely cobbly loam about 7 inches thick. Fractured limestone is at a depth of 7 to 20 inches.

Permeability of the Starley soil is moderate. The hazard of water erosion is slight to moderate.

The average annual production of air-dry vegetation ranges from 1,200 to 1,700 pounds per acre.

The major limitation for producing forage on this unit is droughtiness.

40—Tellman-Granile-Agneston association, 2 to 20 percent slopes. This map unit is on mountainsides, fans, and outwash plains. The natural vegetation is mainly lodgepole pine and grouse whortleberry. Elevation is 7,500 to 9,500 feet. The average annual precipitation is about 15 to 30 inches.

This unit is 35 percent Tellman sandy loam, 30 percent Granile gravelly sandy loam, and 25 percent Agneston sandy loam. The Tellman soil is in the more gently sloping areas on alluvial fans and outwash plains, the Granile soil is in the moderately sloping areas, and the Agneston soil is in the more steeply sloping areas. Included in this unit are small areas of granitic Rock outcrop, soils that are similar to the Agneston soil but are shallow, Leighcan soils, and Burgess and Lucky soils in small meadows. Included areas make up about 10 percent of this unit.

The Tellman soil is deep and well drained. It formed in alluvium or residuum derived dominantly from granite. Typically, the surface is covered with a mat of needles and twigs about 2 inches thick. The surface layer is very dark grayish brown sandy loam about 1 inch thick. The subsurface layer is brown and dark yellowish brown gravelly coarse sandy loam and gravelly sandy clay loam about 9 inches thick. The subsoil is brown and dark yellowish brown gravelly sandy clay loam about 25 inches thick. The substratum is yellowish brown loamy coarse sand about 25 inches thick. Granite is at a depth of 60 inches or more.

Permeability of the Tellman soil is moderate. The hazard of water erosion is slight.

The average annual production of wood fiber is about 20 cubic feet per acre for lodgepole pine.

The Granile soil is deep and well drained. It formed in residuum derived dominantly from granite. Typically, the surface is covered with a mat of needles and twigs about 1 inch thick. The surface layer is dark yellowish brown gravelly sandy loam about 2 inches thick. The subsurface layer is dark yellowish brown and yellowish brown very gravelly coarse sandy loam and coarse sandy clay loam about 10 inches thick. The subsoil is yellowish brown very cobbly sandy clay loam about 8 inches thick. The substratum is brown very cobbly sandy loam about 25 inches thick. Granite is at a depth of 40 to 60 inches.

Permeability of the Granile soil is moderate. The hazard of water erosion is slight.

The average annual production of wood fiber is about 29 cubic feet per acre for lodgepole pine.

The Agneston soil is moderately deep and well drained. It formed in residuum derived dominantly from granite. Typically, the surface is covered with a mat of mosses and litter about 1 inch thick. The surface layer is very dark grayish brown sandy loam about 2 inches thick. The subsurface layer is brown gravelly coarse sandy loam about 5 inches thick. The upper part of the subsoil is dark yellowish brown very cobbly sandy clay loam about 15 inches thick, and the lower part is dark brown very cobbly fine sandy loam about 6 inches thick. Fractured granite is at a depth of 20 to 40 inches.

Permeability of the Agneston soil is moderately slow. The hazard of water erosion is slight to moderate.

The average annual production of wood fiber is about 27 cubic feet per acre for lodgepole pine.

There are no major limitations for producing and harvesting timber on this unit.

41—Tine-Fourmile association, 2 to 30 percent slopes. This map unit is on glacial moraines. The natural vegetation is mainly big sagebrush and Idaho fescue on the Tine soil and Idaho fescue and silky lupine on the Fourmile soil. Elevation is 6,500 to 8,000 feet. The average annual precipitation is about 15 to 25 inches.

This unit is 50 percent Tine very cobbly loam, 30 percent Fourmile loam, and 10 percent included areas of soils that are similar to the Tine soil but have a thicker surface layer. The Tine soil is in convex areas on moraine ridges and side slopes, the Fourmile soil is in the more gently sloping areas on moraine side slopes and in depressional areas, and the soils that are similar to the Tine soil are on moraine side slopes that commonly have a north aspect. Also included in this unit are small areas of soils that are similar to the Fourmile soil but have a thicker surface layer; these included areas make up about 10 percent of this unit.

The Tine soil is deep and somewhat excessively drained. It formed in glacial till derived dominantly from granite. The surface layer is very dark grayish brown very cobbly loam about 9 inches thick. The upper part of the substratum is dark brown very cobbly sandy loam about 5 inches thick, and the lower part is yellowish brown extremely stony sand about 46 inches thick. Granite is at a depth of 60 inches or more.

Permeability of the Tine soil is moderate. The hazard of water erosion is slight.

The average annual production of air-dry vegetation ranges from 1,500 to 1,800 pounds per acre.

The Fourmile soil is deep and well drained. It formed in glacial till derived dominantly from granite. The surface layer is very dark brown and dark brown loam and gravelly loam about 10 inches thick. The subsoil is brown and dark yellowish brown very cobbly sandy clay loam about 14 inches thick. The substratum is dark yellowish brown extremely cobbly loamy coarse sand about 17 inches thick. Granite is at a depth of 60 inches or more.

Permeability of the Fourmile soil is moderate. The hazard of water erosion is slight.

The average annual production of air-dry vegetation ranges from 1,500 to 1,800 pounds per acre.

There are no major limitations for producing forage on this unit.

42—Tolman-Beenom Variant-Carbol Variant association, 5 to 35 percent slopes. This map unit is on mountainsides and toe slopes. The natural vegetation is mainly bluebunch wheatgrass and prairie junegrass. Elevation is 5,400 to 7,000 feet. The average annual precipitation is about 16 to 18 inches.

This unit is 35 percent Tolman channery loam, 30 percent Beenom Variant fine sandy loam, and 20 percent Carbol Variant loam. The Tolman and Carbol Variant soils are in the steeper areas on side slopes, and the Beenom Variant soil is in the more gently sloping areas on side slopes and toe slopes. Included in this unit are small areas of deep soils that are similar to the Tolman soil but have a thicker dark-colored surface layer. Also included are small areas of reddish soils that are loamy and clayey; these included areas make up about 15 percent of this unit.

The Tolman soil is shallow and well drained. It formed in residuum derived dominantly from limestone and calcareous sandstone. The surface layer is very dark brown channery loam about 4 inches thick. The subsoil is very dark grayish brown and dark brown very channery clay loam about 11 inches thick. Hard, calcareous sandstone and cherty limestone are at a depth of 10 to 20 inches.

Permeability of the Tolman soil is moderate. The hazard of water erosion is slight.

The average annual production of air-dry vegetation ranges from 1,500 to 1,800 pounds per acre.

The Beenom Variant soil is moderately deep and well drained. It formed in residuum derived dominantly from interbedded shale and calcareous sandstone. The surface layer is very dark brown fine sandy loam about 6 inches thick. The upper part of the subsoil is very dark grayish brown and brown cobbly clay loam and cobbly silty clay loam about 17 inches thick, and the lower part is brown gravelly silty clay loam about 9 inches thick. Interbedded shale and calcareous sandstone are at a depth of 20 to 40 inches.

Permeability of the Beenom Variant soil is moderately slow. The hazard of water erosion is moderate to severe.

The average annual production of air-dry vegetation ranges from 1,600 to 2,400 pounds per acre.

The Carbol Variant soil is shallow and well drained. It formed in residuum derived dominantly from limestone and calcareous sandstone. The surface layer is very dark grayish brown loam about 4 inches thick. The subsoil is dark brown and brown clay loam and gravelly clay loam about 11 inches thick. Hard, sandy limestone and calcareous sandstone are at a depth of 10 to 20 inches.

Permeability of the Carbol Variant soil is moderate. The hazard of water erosion is moderate to severe.

The average annual production of air-dry vegetation ranges from 1,500 to 1,800 pounds per acre.

The major limitation for producing forage on this unit is droughtiness of the Tolman and Carbol Variant soils. The hazard of erosion on the Beenom Variant and Carbol Variant soils makes careful grazing management necessary.

43—Tongue River-Gateway association, 2 to 35 percent slopes. This map unit is on mountainsides. The natural vegetation is mainly lodgepole pine and grouse whortleberry on the Tongue River soil and Engelmann spruce and grouse whortleberry on the Gateway soil (fig. 13). Elevation is 8,000 to 9,500 feet. The average annual precipitation is about 25 to 35 inches.

Figure 13.—Timbered areas of Tongue River-Gateway association, 2 to 35 percent slopes. Area of Owen Creek-Echemoor-Bynum association, 2 to 30 percent slopes, in foreground.

This unit is 40 percent Tongue River loam, 35 percent Gateway loam, and about 10 percent included areas of soils that are similar to the Gateway soil but have a thick, dark-colored surface layer. The Tongue River soil is on side slopes that are influenced by sandstone, the Gateway soil is on side slopes that are influenced by shale, and the soil that is similar to the Gateway soil is in small grassy parks. Also included in this unit are small areas of Cloud Peak soils, soils that are similar to the Gateway soil but are shallow, soils that are similar to the Tongue River soil but have a thicker dark-colored surface layer, soils that are similar to the Tongue River soil but are sandy, and small slumps; these included area make up about 15 percent of this unit.

The Tongue River soil is moderately deep and well drained. It formed in residuum derived dominantly from interbedded shale and sandstone. Typically, the surface is covered with a mat of partly decomposed needles and twigs about 1 inch thick. The surface layer is very dark grayish brown loam about 3 inches thick. The subsurface layer is dark brown light sandy clay loam about 4 inches thick. The subsoil is brown and dark yellowish brown sandy clay loam and sandy loam about 22 inches thick. The substratum is brown sandy loam about 3 inches thick. Interbedded sandstone and shale are at a depth of 20 to 40 inches.

Permeability of the Tongue River soil is moderate. The hazard of water erosion is moderate to severe.

The average annual production of wood fiber is about 29 cubic feet per acre for lodgepole pine.

The Gateway soil is moderately deep and well drained. It formed in residuum derived dominantly from interbedded shale and limestone. Typically, the surface is covered with a mat of partly decomposed twigs and needles about 1 inch thick. The surface layer is very dark grayish brown loam about 1 inch thick. The subsurface layer is dark grayish brown clay loam about 2 inches thick. The subsoil and substratum are grayish brown and olive clay about 23 inches thick. Shale is at a depth of 20 to 40 inches.

Permeability of the Gateway soil is slow. The hazard of water erosion is slight.

The average annual production of wood fiber is about 71 cubic feet per acre for Engelmann spruce.

The major limitations for producing and harvesting timber on this unit are frequent mass movement of soil and, on the Gateway soil, high shrink-swell potential. The hazard of erosion on the Tongue River soil necessitates careful logging.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for forestry, range, watershed management, and transportation systems. It can be used to identify the potentials and limitations of each soil for specific land uses.

This soil survey is not intended to eliminate the need for onsite soil investigations. Certain land uses, such as camp areas, picnic areas, and gravel pits, are site-specific and thus require detailed investigations. Management of such areas as those used for timber production and harvest and road construction can be planned using information in this report, but it is recommended that all such areas also have onsite project investigations.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Range

Forage is an important resource in the Bighorn National Forest. Local ranchers are dependent on more than 100 livestock allotments that produce summer forage for cattle, sheep, and horses.

The climate and soils in the survey area greatly influence the kinds and amounts of forage produced. The lower elevations generally are drier and support bluebunch wheatgrass and shrubby vegetation. Much of the area, however, supports Idaho fescue and sedges, with the riparian areas supporting lush stands of tufted hairgrass, timothy, and sedges. The higher elevations support alpine vegetation. In areas that have similar climate and topography, the amount of forage produced is closely related to the kind of soil. Effective management is based on the relationship between soils, vegetation, and water.

The limitations for revegetation of each soil in the survey area are given in table 3. The inherent limitations of the soils to support the establishment and growth of grasses and shrubs are rated. For those soils rated as having severe limitations, the most limiting factor or factors are given.

Soils are rated in their "natural" state; that is, no unusual modifications of the soil site or material are made other than those that are considered normal practices for the rated use. Only the most restrictive features are listed.

Slight is the limitation rating given soils that have properties favorable for the use. The degree of limitation is minor and can be overcome easily. Good performance and low maintenance can be expected.

Moderate is the limitation rating given soils that have properties moderately favorable for the use. This degree of limitation can be overcome or modified by special planning, design, or maintenance. During some part of the year, the expected performance of the structure or other planned use is somewhat less desirable than the soils rated *slight*. Some soils rated *moderate* require treatment such as control of runoff to reduce erosion, or some modification of certain features through manipulation of the soil.

Severe is the limitation rating given soils that have one or more properties unfavorable for the rated use, such as steep slopes, bedrock near the surface, flooding, high shrink-swell potential, a seasonal high water table, or low strength. This degree of limitation generally requires major soil reclamation, special design, or intensive maintenance. Some of these soils, however, can be improved by reducing or removing the soil feature that limits use, but in most situations, it is difficult and costly to alter the soil or to design a structure so as to compensate for a severe degree or limitation.

Table 4 gives the plant association for each soil. For a more detailed description of plant communities, refer to "Vegetation" in the section "General Nature of the Survey Area." Potential forage production (*12*), in pounds per acre per year, dry weight, is also given in table 4.

The objective in range management is to control grazing so that the plants growing on a site are about

the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, reduction of undesirable brush species, conservation of water, and control of erosion.

Timber

The main forest cover types in the survey area are ponderosa pine, Douglas-fir, lodgepole pine, and Englemann spruce-subalpine fir. Of these, lodgepole pine, Englemann spruce, and Douglas-fir are important timber species.

Approximately 62 percent of the survey area is forested, and about 48 percent is commercial forest land that is capable of producing at least 20 cubic feet of wood per year.

The limitations for reforestation are given in table 3 for those soils in the survey area that are capable of supporting forest vegetation. The inherent limitations of these soils to support the establishment and growth of trees are rated. For those soils rated as having severe limitations, the most limiting factor or factors are given. Explanations of these limitations are given in the section "Range."

Forest plant associations (*6*) are given in table 4. A more detailed description of these plant associations is given under "Vegetation" in the section "General Nature of the Survey Area." Average potential timber production, in cubic feet per acre per year, is also given in table 4.

Sound timber management practices, based in part on soil surveys, ensure continued production of timber, protection of soil quality, and prevention of erosion (*10*).

Engineering

The soils of the survey area are rated in table 3 for unsurfaced roads, and the most limiting features are identified. The construction of these roads involves cuts and fills, commonly less than 3 feet, and mixing of soil material in the fill. The rating emphasizes the physical and structural properties of the soils for road building as well as factors important for resource protection.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) make preliminary estimates of construction conditions; (2) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; and (3) plan detailed onsite investigations of soils and geology.

The information in the tables, along with the soil maps and soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 5 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the system adopted by the American Association of State Highway and Transportation Officials (*1*) and the Unified soil classification system (*2, 9*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic-matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 6 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to absorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent;*moderate*, 3 to 6 percent; and *high*, more than 6 percent.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) or the Modified Soil Loss Equation (MSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 6, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning residue to the soil. Organic matter affects the available water capacity, infiltration rate, and physical condition of the soil. It is a source of nitrogen and other nutrients for vegetation.

Soil and Water Features

Table 7 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse

texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink- swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*3, 14*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 8 the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquents (*Hapl*, meaning minimal horizonation, plus *aquent*, the suborder of the Entisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, nonacid, mesic Typic Haplaquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series. the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*13*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*14*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Agneston Series

The Agneston series consists of moderately deep, well drained soils that formed in residuum derived from granite. These soils are on mountainsides and glacial trough valley sides. The natural vegetation is mainly lodgepole pine (*Pinus contorta*) and grouse whortleberry (*Vaccinium scoparium*). Some Engelmann spruce (*Picea engelmannii*) and grouse whortleberry (*Vaccinium scoparium*) are on north aspects and at the higher elevations. Slope is 5 to 50 percent.

Taxonomic class: Loamy-skeletal, mixed Typic Cryoboralfs

Typical pedon: Agneston sandy loam in an area of Agneston-Leighcan association, 5 to 30 percent slopes; sec. 1, T. 48 N., R. 85 W.

O1—1 inch to 0; mosses and litter.
A1—0 to 2 inches; very dark grayish brown (10YR 3/2) sandy loam, brown (10YR 5/3) dry; moderate fine granular structure; very friable, slightly sticky and slightly plastic; 10 percent gravel; strongly acid (pH 5.2); clear smooth boundary.
A2—2 to 7 inches; brown (10YR 4/3) gravelly coarse sandy loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure parting to moderate fine granular; very friable, nonsticky and nonplastic; 20 percent gravel, 5 percent cobbles; strongly acid (pH 5.4); clear wavy boundary.
B2t—7 to 22 inches; dark yellowish brown (10YR 4/4) very cobbly sandy clay loam, yellowish brown (10YR 5/4) dry; strong medium and fine subangular blocky structure; friable, sticky and plastic; common thin clay films bridging sand grains on peds and in pores; 25 percent gravel, 15 percent cobbles; strongly acid (pH 5.5); clear smooth boundary.
B3—22 to 28 inches; dark brown (10YR 4/3) very cobbly fine sandy loam, brown (10YR 5/3) dry; moderate medium and fine subangular blocky structure; very friable, slightly sticky and slightly plastic; 25 percent gravel, 20 percent cobbles; medium acid (pH 5.9); abrupt smooth boundary.
R—28 inches; hard fractured granite.

Range in characteristics

A2 horizon: Color—hue - 10YR or 7.5YR, value - 6 or 7 (dry) and 4 or 5 (moist), chroma - 3 or 4; texture—loam, sandy loam, coarse sandy loam; rock fragment content—15 to 35 percent; reaction—pH 4.5 to 6.0

B2t horizon: Color—hue - 10YR or 7.5YR, value - 5 to 7 (dry) and 4 or 5 (moist), chroma - 3 to 6; rock fragment content—35 to 55 percent; reaction—pH 4.5 to 5.5

Beenom Variant

The Beenom Variant consists of moderately deep, well drained soils that formed in residuum derived from interbedded shale and calcareous sandstone. These soils are on mountainsides. The natural vegetation is mainly bluebunch wheatgrass (*Agropyron spicatum*) and prairie junegrass (*Koeleria cristata*). Slope is 5 to 35 percent.

Taxonomic class: Fine-loamy, mixed Typic Argiborolls

Typical pedon: Beenom Variant fine sandy loam in an area of Tolman-Beenom Variant-Carbol Variant association, 5 to 35 percent slopes; sec. 14, T. 58 N., R. 90 W.

A1—0 to 6 inches; very dark brown (10YR 2/2) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak medium and fine granular structure parting to single grain; very friable, slightly sticky and slightly plastic; 5 percent gravel; neutral (pH 6.8); clear smooth boundary.
B21t—6 to 12 inches; very dark grayish brown (10YR 3/2) cobbly clay loam, dark grayish brown (10YR 4/2) dry; strong medium and fine subangular blocky structure; friable, slightly sticky and slightly plastic; common thin clay films on faces of peds and in pores; 5 percent gravel, 10 percent cobbles; neutral (pH 6.7); clear smooth boundary.
B22t—12 to 23 inches; brown (10YR 4/3) cobbly silty clay loam, brown (10YR 5/3) dry; weak medium prismatic structure parting to strong medium angular blocky; friable, sticky and plastic; many moderately thick clay films on faces of peds and in pores; 10 percent gravel, 10 percent cobbles; neutral (pH 6.8); clear wavy boundary.
B3ca—23 to 32 inches; brown (10YR 4/3) gravelly silty clay loam, pale brown (10YR 6/3) dry; moderate medium and fine subangular blocky structure; friable, sticky and plastic; common moderately thick clay films on faces of peds; 10 percent gravel, 5 percent cobbles; strongly effervescent; mildly alkaline (pH 7.6); clear smooth boundary.
Cr—32 inches; soft interbedded shale and calcareous sandstone.

Range in characteristics

Mollic epipedon: Thickness—12 to 16 inches

Profile: Rock fragment content—0 to 35 percent throughout

A1 horizon: Color—value - 3 or 4 (dry) and 2 or 3 (moist), chroma - 2 or 3; texture—fine sandy loam, loam, silt loam; reaction—pH 6.6 to 7.3

Bt horizon: color—hue - 10YR or 7.5YR, value - 4 or 5 (dry) and 3 or 4 (moist), chroma - 2 or 3; texture—loam, silty clay loam, clay loam; reaction—pH 6.6 to 7.3

Bottle Series

The Bottle series consists of moderately deep, well drained to excessively drained soils that formed in residuum derived from sandstone. These soils are on mountainsides. The natural vegetation is mainly lodgepole pine (*Pinus contorta*) and grouse whortleberry (*Vaccinium scoparium*). Slope is 5 to 30 percent.

Taxonomic class: Sandy, mixed Dystric Cryochrepts

Typical pedon: Bottle sandy loam in an area of Sapphire-Bottle-Foxton association, 2 to 35 percent slopes; NW1/4 of sec. 6, T. 49 N., R. 86 W.

O2—3 inches to 0; partly decomposed twigs and needles.
A1—0 to 4 inches; dark brown (10YR 3/3) sandy loam, brown (10YR 5/3) dry; moderate fine and medium granular structure; friable, slightly sticky and slightly

plastic; 5 percent channery fragments; medium acid (pH 5.7); clear wavy boundary.

A2—4 to 8 inches; brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; single grain; loose, nonsticky and nonplastic; 10 percent channery fragments; medium acid (pH 5.7); clear wavy boundary.

B2—8 to 15 inches; yellowish brown (10YR 5/6) gravelly fine sandy loam, light yellowish brown (10YR 6/4) dry; single grain; loose, nonsticky and nonplastic; 20 percent gravel; strongly acid (pH 5.4); clear wavy boundary.

C—15 to 27 inches; yellowish brown (10YR 5/4) very gravelly sand, very pale brown (10YR 7/3) dry; single grain; loose, nonsticky and nonplastic; 35 percent gravel; medium acid (pH 5.6); clear wavy boundary.

R—27 inches; hard sandstone.

Range in characteristics

Cambic horizon: Depth to base—0 to 15 inches

Profile: Rock fragment content—5 to 20 percent in B horizon, 5 to 35 percent in C horizon

A2 horizon: Color—hue - 10YR to 5YR, value - 4 to 6 (dry) and 4 or 5 (moist), chroma - 2 to 4; texture—sandy loam, fine sandy loam; reaction—pH 5.1 to 6.0

B2 horizon: Color—hue - 10YR to 5YR, value - 6 or 7 (dry) and 4 or 5 (moist), chroma - 3 to 6; texture—fine sandy loam, sandy loam; reaction—pH 5.1 to 6.0

C horizon: Texture—loamy sand, fine sand, sand; reaction—pH 5.6 to 6.0

Bross Series

The Bross series consists of deep, well drained soils that formed in glacial till or residuum derived from granite. These soils are on moraines and mountainsides. The natural vegetation is mainly an alpine plant community. Slope is 2 to 25 percent.

Taxonomic class: Loamy-skeletal, mixed Pergelic Cryumbrepts

Typical pedon: Bross gravelly loam in an area of Mirror-Teewinot-Bross association, 2 to 40 percent slopes; NE1/4 of sec. 32, T. 50 N., R. 86 W.

A11—0 to 2 inches; very dark brown (10YR 2/2) gravelly loam, dark brown (10YR 4/3) dry; moderate very fine granular structure; very friable, slightly sticky and slightly plastic; 10 percent gravel, 5 percent cobbles, 5 percent stones; strongly acid (pH 5.1); clear smooth boundary.

A12—2 to 10 inches; very dark grayish brown (10YR 3/2) very cobbly loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure parting to moderate fine granular; very friable, slightly sticky and slightly plastic; 10 percent gravel, 20 percent cobbles, 5 percent stones; strongly acid (pH 5.2); clear wavy boundary.

B2—10 to 27 inches; dark yellowish brown (10YR 3/6) very cobbly loam, yellowish brown (10YR 5/4) dry; weak medium subangular blocky structure parting to moderate fine granular; very friable, slightly sticky and slightly plastic; 20 percent gravel, 30 percent cobbles, 5 percent stones; very strongly acid (pH 5.0); clear wavy boundary.

C1—27 to 34 inches; dark yellowish brown (10YR 4/4) very cobbly sandy loam, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure parting to single grain; soft, loose, slightly sticky and slightly plastic; 15 percent gravel, 15 percent cobbles, 5 percent stones; strongly acid (pH 5.4); clear wavy boundary.

C2—34 to 42 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure parting to single grain; soft, loose, slightly sticky and slightly plastic; 20 percent gravel, 5 percent cobbles; strongly acid (pH 5.4).

Range in characteristics

Profile: Depth to bedrock—60 inches or more

Control section: Rock fragment content—35 to 60 percent

Umbric epipedon: Thickness—9 to 13 inches

A1 horizon: Color—value - 4 or 5 (dry) and 2 or 3 (moist), chroma - 2 to 4; reaction—pH 4.5 to 5.5

B2 horizon: Color—value - 5 or 6 (dry) and 3 or 4 (moist), chroma - 4 to 6; texture—loam, fine sandy loam; reaction—pH 4.5 to 5.5

C horizon: Texture—fine sandy loam, sandy loam, loamy fine sand; reaction—pH 4.5 to 6.0

Burgess Series

The Burgess series consists of moderately deep, well drained soils that formed in residuum derived from granite. These soils are on mountainsides. The natural vegetation is mainly Idaho fescue (*Festuca idahoensis*) and sedges (*Carex spp.*). Slope is 2 to 30 percent.

Taxonomic class: Coarse-loamy, mixed Argic Cryoborolls

Typical pedon: Burgess loam in an area of Lucky-Burgess-Hazton association, 2 to 30 percent slopes; SW1/4 of sec. 21, T. 50 N., R. 84 W.

A1—0 to 3 inches; very dark brown (10YR 2/2) loam, dark brown (10YR 3/3) dry; weak fine and very fine granular structure; friable, slightly sticky and slightly plastic; 5 percent gravel; neutral (pH 7.0); abrupt wavy boundary.

B21t—3 to 7 inches; dark brown (10YR 3/3) gravelly sandy loam, dark yellowish brown (10YR 4/4) dry; weak fine subangular blocky structure; friable, slightly sticky and slightly plastic; common thin clay

films on faces of peds; 20 percent gravel; slightly acid (pH 6.5); clear wavy boundary.

B22t—7 to 11 inches; brown (10YR 4/3) gravelly sandy loam, yellowish brown (10YR 5/4) dry; weak fine subangular blocky structure; friable, nonsticky and nonplastic; few thin clay films on faces of peds; 20 percent gravel; slightly acid (pH 6.5); clear wavy boundary.

C1—11 to 25 inches; brown (10YR 4/3) gravelly sandy loam, yellowish brown (10YR 5/4) dry; single grain; loose, nonsticky and nonplastic; 30 percent gravel; slightly acid (pH 6.5); clear wavy boundary.

C2—25 to 29 inches; yellowish brown (10YR 5/4) very gravelly loamy sand, pale brown (10YR 6/3) dry; single grain; loose, nonsticky and nonplastic; 40 percent angular gravel; slightly acid (pH 6.5); abrupt wavy boundary.

R—29 inches; hard fractured granite.

Range in characteristics

Mollic epipedon: Thickness—7 to l3 inches

A1 horizon: Color—hue - 10YR or 7.5YR, value - 3 to 5 (dry) and 2 or 3 (moist), chroma - 2 or 3; texture—loam, gravelly sandy loam; reaction—pH 6.6 to 7.3

B2t horizon: Color—hue - 10YR or 7.5YR, value - 4 or 5 (dry) and 3 or 4 (moist), chroma - 3 or 4; texture—gravelly sandy loam, sandy loam; reaction—pH 5.1 to 6.5

C horizon: Texture—gravelly sandy loam, gravelly loamy sand, very gravelly loamy sand; reaction—pH 5.1 to 6.5

Bynum Series

The Bynum series consists of moderately deep, well drained soils that formed in residuum derived from interbedded shale and sandstone. These soils are on mountainsides and ridges. The natural vegetation is mainly big sagebrush (*Artemisia tridentata*) and Idaho fescue (*Festuca idahoensis*). Slope is 10 to 30 percent.

Taxonomic class: Fine-loamy, mixed Typic Cryoborolls

Typical pedon: Bynum silt loam in an area of Owen Creek-Echemoor-Bynum association, 2 to 30 percent slopes; SE1/4 of sec. 13, T. 48 N., R. 84 W.

A11—0 to 7 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium prismatic structure parting to moderate medium granular; friable, nonsticky and nonplastic, neutral (pH 7.0); clear wavy boundary.

A12—7 to 11 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak medium granular structure; friable, slightly sticky and slightly plastic; 5 percent cobbles; neutral (pH 7.2); gradual wavy boundary.

B2—11 to 17 inches; olive (5Y 5/3) channery clay loam, light brownish gray (10YR 6/2) dry; moderate fine subangular blocky structure; friable, sticky and plastic; 20 percent channery fragments; violently effervescent; neutral (pH 7.2); gradual wavy boundary.

C1ca—17 to 27 inches; grayish brown (2.5Y 5/2) channery clay loam, light brownish gray (2.5Y 6/2) dry; moderate fine subangular blocky structure; friable, sticky and plastic; 30 percent channery fragments; violently effervescent; mildly alkaline (pH 7.6); gradual wavy boundary.

C2r—27 inches; soft calcareous shale.

Range in characteristics:

Solum: Thickness—17 to 22 inches; depth to calcium carbonate—15 to 17 inches

Control section: Texture—silty clay loam, clay loam, channery clay loam

A1 horizon: Color—value - 4 or 5 (dry) and 2 or 3; reaction—pH 6.6 to 7.3

B2 horizon: Color—hue - 10YR to 5Y, value - 4 to 6 (dry) and 4 or 5 (moist); reaction—pH 6.6 to 7.3

Cca horizon: Color—hue - 2.5Y or 5Y; reaction—pH 7.4 to 7.8

Carbol Series

The Carbol series consists of shallow, well drained soils that formed in residuum derived from hard sandstone. These soils are on mountainsides and ridges. The natural vegetation is mainly Idaho fescue (*Festuca idahoensis*) and sedges (*Carex spp.*). Slope is 5 to 20 percent.

Taxonomic class: Loamy, mixed Argic Lithic Cryoborolls

Typical pedon: Carbol loam in an area of Inchau-Carbol association, 2 to 20 percent slopes; NW1/4 of sec. 28, T. 56 N., R. 91 W.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable, slightly sticky; 10 percent gravel; medium acid (pH 6.0); clear smooth boundary.

B1—3 to 6 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; very friable, slightly sticky; few thin clay films bridging sand grains; 10 percent gravel; medium acid (pH 5.6); abrupt smooth boundary.

B2t—6 to 12 inches; brown (7.5YR 4/2) gravelly sandy clay loam, brown (7.5YR 5/2) dry; weak medium subangular blocky structure parting to moderate medium granular; very friable, slightly sticky and slightly plastic; common moderately thick clay films on faces of peds and bridging sand grains; 15 percent fine gravel; medium acid (pH 5.6); abrupt smooth boundary.

R—12 inches; hard sandstone.

Range in characteristics
A1 horizon: Color—hue - 10YR or 7.5YR, value - 4 or 5 (dry) and 2 or 3 (moist), chroma - 2 or 3; texture—loam, sandy loam; reaction—pH 5.6 to 6.5
Bt horizon: color—hue - 10YR or 7.5YR, value - 5 or 6 (dry) and 4 or 5 (moist), chroma - 2 to 4; texture—sandy clay loam, gravelly sandy clay loam; reaction—pH 5.6 to 6.5

Carbol Variant

The Carbol Variant consists of shallow, well drained soils that formed in residuum derived from limestone and calcareous sandstone. These soils are on mountainsides. The natural vegetation is mainly bluebunch wheatgrass (*Agropyron spicatum*) and prairie junegrass (*Koeleria cristata*). Slope is 5 to 35 percent.

Taxonomic class: Loamy, mixed Lithic Argiborolls

Typical pedon: Carbol Variant loam in an area of Tolman-Beenom Variant-Carbol Variant association, 5 to 35 percent slopes; sec. 15, T. 56 N., R. 87 W.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; very friable, slightly sticky and slightly plastic; 5 percent gravel; mildly alkaline (pH 7.4); clear wavy boundary.

B2t—4 to 9 inches; dark brown (7.5YR 3/2) clay loam, brown (10YR 4/3) dry; strong medium and fine angular blocky structure; firm, sticky and plastic; many moderately thick clay films on faces of peds; 10 percent gravel; mildly alkaline (pH 7.6); clear smooth boundary.

B3ca—9 to 15 inches; brown (10YR 4/3) gravelly clay loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; very friable, slightly sticky and slightly plastic; 30 percent gravel; violently effervescent; mildly alkaline (pH 7.8); clear wavy boundary.

R—15 inches; hard calcareous sandstone.

Range in characteristics
Mollic epipedon: Thickness—8 to 9 inches
Control section: Rock fragment content—5 to 35 percent
A1 horizon: Color—hue - 10YR or 7.5YR, value - 4 or 5 (dry) and 2 or 3 (moist), chroma - 2 or 3; texture—loam, gravelly loam; reaction—pH 7.4 to 7.8
B2t horizon: Color—hue - 10YR or 7.5YR, value - 4 or 5 (dry) and 3 or 4 (moist), chroma - 2 or 3; texture—clay loam, gravelly clay loam; reaction—pH 7.4 to 7.8

Chilton Variant

The Chilton Variant consists of deep, well drained soils that formed in alluvium or colluvium derived from limestone. These soils are on fans and foot slopes. The natural vegetation is mainly Utah juniper (*Juniperus osteosperma*) and big sagebrush (*Artemisia tridentata*). Slope is 5 to 20 percent.

Taxonomic class: Loamy-skeletal, mixed (calcareous), mesic Ustic Torriorthents

Typical pedon: Chilton Variant very channery loam in an area of Chilton Variant-Sunup-Spearfish Variant association, 5 to 60 percent slopes; SW1/4 of sec. 31, T. 54 N., R. 90 W.

A1—0 to 3 inches; dark brown (7.5YR 4/4) very channery loam, light brown (7.5YR 6/4) dry; weak medium and fine granular structure; friable, slightly sticky and slightly plastic; 55 percent channery fragments; strongly effervescent; moderately alkaline (pH 8.2); gradual irregular boundary.

C1ca—3 to 12 inches; brown (7.5YR 5/4) very channery loam, pink (7.5YR 7/4) dry; massive; friable, slightly sticky and slightly plastic; 55 percent channery fragments; violently effervescent; moderately alkaline (pH 8.2); gradual wavy boundary.

C2ca—12 to 42 inches; brown (7.5YR 5/4) extremely channery loam, pinkish gray (7.5YR 7/2) dry; massive; friable, slightly sticky and slightly plastic; 70 percent channery fragments; violently effervescent; strongly alkaline (pH 8.6).

Range in characteristics
Profile: Depth to bedrock—40 to 60 inches; rock fragment content—40 to 70 percent throughout
A1 horizon: Color—hue - 7.5YR to 2.5YR; reaction—pH 7.9 to 8.4
Cca horizon: Color—hue - 7.5YR or 5YR; reaction—pH 7.9 to 9.0

Cloud Peak Series

The Cloud Peak series consists of moderately deep, well drained soils that formed in residuum or colluvium derived from limestone. These soils are on mountainsides. The natural vegetation is mainly Douglas-fir (Pseudotsuga menziesii) and mountain ninebark (*Physocarpus monogynus*) or Engelmann spruce (*Picea engelmannii*) and grouse whortleberry (*Vaccinium scoparium*). Slope is 5 to 45 percent.

Taxonomic class: Loamy-skeletal, mixed Typic Cryoboralfs

Typical pedon: Cloud Peak gravelly silt loam in an area of Cloud Peak gravelly silt loam, 5 to 45 percent slopes; SE1/4 of sec. 32, T. 49 N., R. 83 W.

O1—2 inches to 0; needles and partially decomposed leaf litter.

A2—0 to 2 inches; dark brown (7.5YR 4/4) gravelly silt loam, brown (10YR 5/3) dry; moderate medium granular structure; friable, slightly sticky and slightly plastic; 15 percent gravel; slightly acid (pH 6.3); clear wavy boundary.

B2t—2 to 12 inches; brown (10YR 4/3) very gravelly silty clay loam, yellowish brown (10YR 5/4) dry; moderate medium angular blocky structure; friable, sticky and plastic; common thin clay films on faces of peds and in pores; 40 percent gravel; slightly acid (pH 6.5); gradual wavy boundary.

B3ca—12 to 22 inches; yellowish brown (10YR 5/4) very gravelly silty clay loam, pale brown (10YR 6/3) dry; weak fine and medium angular blocky structure; friable, slightly sticky and slightly plastic; few thin clay films on faces of peds; 40 percent gravel, 10 percent cobbles; strongly effervescent; lime disseminated throughout; mildly alkaline (pH 7.5); gradual wavy boundary.

Cca—22 to 38 inches; brown (10YR 5/3) very cobbly silt loam, very pale brown (10YR 7/3) dry; massive; friable, nonsticky and slightly plastic; 15 percent gravel, 40 percent cobbles; violently effervescent; lime in seams and disseminated; mildly alkaline (pH 7.8); abrupt irregular boundary.

R—38 inches; hard fractured limestone.

Range in characteristics

Solum: Thickness—15 to 40 inches; depth to calcium carbonate—12 to 22 inches

Profile: Rock fragment content—40 to 70 percent in B and C horizons

A2 horizon: Color—hue - 10YR or 7.5YR, value - 5 or 6 (dry) and 3 or 4 (moist), chroma - 2 to 4; texture—silt loam, loam; reaction—pH 6.1 to 7.3

B2t horizon: Color—hue - 10YR to 5YR, value - 4 or 5 (dry) and 3 or 4 (moist), chroma - 2 to 6; texture—silty clay loam, clay loam; reaction—pH 6.1 to 7.8

Cca horizon: Color—hue - 7.5YR to 2.5Y, value - 5 to 7 (dry) and 4 to 6 (moist), chroma - 2 to 4; texture—loam, clay loam, silt loam; reaction—pH 7.4 to 7.8

Echemoor Series

The Echemoor series consists of moderately deep, well drained soils that formed in residuum or alluvium derived from calcareous shale and limestone. These soils are on toe slopes and fans. The natural vegetation is mainly big sagebrush (*Artemisia tridentata*) and Idaho fescue (*Festuca idahoensis*). Slope is 2 to 20 percent.

Taxonomic class: Fine-loamy, mixed Argic Pachic Cryoborolls

Typical pedon: Echemoor silt loam in an area of Owen Creek-Echemoor-Bynum association, 2 to 30 percent slopes; NE1/4 of sec. 30, T. 54 N., R. 85 W.

A11—0 to 2 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; strong fine and very fine granular structure; very friable, slightly sticky and slightly plastic; medium acid (pH 6.0); abrupt wavy boundary.

A12—2 to 14 inches; very dark brown (10YR 2/2) silt loam, brown (10YR 4/3) dry; moderate fine and very fine granular structure; friable, slightly sticky and slightly plastic; medium acid (pH 5.8); clear wavy boundary.

B21t—14 to 20 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate medium and fine subangular blocky structure; friable, sticky and plastic; few thin clay films on faces of peds; medium acid (pH 5.9); clear irregular boundary.

B22t—20 to 33 inches; light olive brown (2.5Y 5/4) silty clay loam, light yellowish brown (2.5Y 6/4) dry; weak fine angular blocky structure; friable, sticky and plastic; common thin clay films on faces of peds; neutral (pH 7.0); clear wavy boundary.

Cr—33 inches; olive (5Y 5/4) clay shale fragments, pale olive (5Y 6/4) dry; massive; friable, sticky and very plastic; strongly effervescent; neutral (pH 7.3).

Range in characteristics

Mollic epipedon: Thickness—18 to 23 inches

Solum: Thickness—23 to 33 inches

A1 horizon: Color—hue - 10YR or 2.5Y, value - 4 or 5 (dry) and 2 or 3 (moist), chroma - 1 to 3; reaction—pH 5.6 to 7.3

B2t horizon: Color—hue - 10YR to 5Y, value - 5 or 6 (dry) and 3 to 5 (moist), chroma - 2 to 4; texture—silty clay loam, clay loam, sandy clay loam; reaction—pH 5.6 to 7.3

Farlow Series

The Farlow series consists of deep, well drained soils that formed in calcareous colluvium derived from limestone. These soils are on old landslide deposits. The natural vegetation is mainly big sagebrush (*Artemisia tridentata*) and Idaho fescue (*Festuca idahoensis*). Slope is 5 to 40 percent.

Taxonomic class: Loamy-skeletal, mixed Typic Cryoborolls

Typical pedon: Farlow gravelly loam in an area of Farlow-Pishkun association, 5 to 40 percent slopes; sec. 5, T. 53 N., R. 89 W.

A1—0 to 8 inches; very dark brown (10YR 2/2) gravelly loam, dark grayish brown (10YR 4/2) dry; strong fine granular structure; friable, nonsticky and slightly plastic; 25 percent gravel; slightly effervescent; mildly alkaline (pH 7.6); gradual irregular boundary.

B2—8 to 16 inches; dark grayish brown (10YR 4/2) gravelly clay loam, pale brown (10YR 6/3) dry; moderate fine and medium subangular blocky structure; friable, slightly sticky and slightly plastic; 30 percent gravel; violently effervescent; mildly alkaline (pH 7.8); gradual wavy boundary.

Cca—16 to 45 inches; brown (10YR 5/3) very gravelly clay loam, very pale brown (10YR 7/3) dry; massive; friable, slightly sticky and slightly plastic; 35 percent

gravel, 10 percent cobbles; violently effervescent; moderately alkaline (pH 8.2).

Range in characteristics

Profile: Depth to bedrock—40 to 60 inches; depth to calcium carbonate—5 to 6 inches

Mollic epipedon: Thickness—8 to 9 inches

A1 horizon: Color—hue - 10YR or 2.5Y, value - 4 or 5 (dry) and 2 or 3 (moist), chroma - 1 or 2; texture—loam, gravelly loam; reaction—pH 7.4 to 7.8

B2 horizon: Color—hue - 10YR or 2.5Y; texture—loam, gravelly loam, gravelly clay loam; reaction—pH 7.4 to 8.4

Cca horizon: Color—hue - 10YR or 2.5Y; texture—very gravelly clay loam, very gravelly loam; reaction—pH 7.9 to 8.4

Fourmile Series

The Fourmile series consists of deep, well drained soils that formed in alluvium or glacial till derived from granite. These soils are on old terraces and moraines. The natural vegetation is mainly Idaho fescue (*Festuca idahoensis*) and silky lupine (*Lupinus sericeus*). Slope is 2 to 30 percent.

Taxonomic class: Loamy-skeletal, mixed Argic Cryoborolls

Typical pedon: Fourmile loam in an area of Fourmile loam, 2 to 30 percent slopes; NW1/4 of sec. 5, T. 50 N., R. 84 W.

A—0 to 6 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak granular structure; very friable, nonsticky and slightly plastic; 5 percent gravel; medium acid (pH 5.7); clear smooth boundary.

A3—6 to l0 inches; dark brown (10YR 3/3) gravelly loam, brown (10YR 4/3) dry; weak granular structure; very friable, slightly sticky and slightly plastic; 20 percent gravel; medium acid (pH 5.7); gradual wavy boundary.

B2t—10 to 19 inches; brown (10YR 4/3) very cobbly sandy clay loam, yellowish brown (10YR 5/4) dry; moderate fine and medium subangular blocky structure; friable, slightly sticky and slightly plastic; common thin clay films on faces of peds; 25 percent gravel, 5 percent cobbles, 5 percent stones; medium acid (pH 5.6); gradual wavy boundary.

B22t—19 to 24 inches; dark yellowish brown (10YR 4/4) very cobbly sandy clay loam, yellowish brown (10YR 5/4) dry; weak subangular blocky structure; friable, sticky and plastic; common thin clay films on faces of peds; 25 percent gravel, 20 percent cobbles, 5 percent stones; medium acid (pH 5.6); gradual wavy boundary.

IIC—24 to 41 inches; dark yellowish brown (10YR 4/4) extremely cobbly loamy coarse sand, light yellowish brown (10YR 6/4) dry; single grain; loose, nonsticky and nonplastic; 25 percent gravel, 30 percent cobbles; 5 percent stones; slightly acid (pH 6.5).

Range in characteristics

Profile: Depth to bedrock—60 inches or more; rock fragment content—35 to 60 percent in B horizon, as much as 75 percent in IIC horizon

A horizon: Color—hue - 10YR or 7.5YR, value - 3 to 5 (dry) and 2 or 3 (moist), chroma - 1 to 3; texture—loam, gravelly loam; reaction—pH 5.6 to 7.3

B2t horizon: Color—hue - 10YR or 7.5YR, value - 5 or 6 (dry) and 4 or 5 (moist), chroma - 2 to 4; reaction—pH 5.6 to 6.5

Foxton Series

The Foxton series consists of moderately deep, well drained soils that formed in residuum derived from interbedded shale, limestone, and sandstone. These soils are on mountainsides. The natural vegetation is mainly lodgepole pine (*Pinus contorta*) and grouse whortleberry (*Vaccinium scoparium*). Slope is 2 to 5 percent.

Taxonomic class: Fine, montmorillonitic Typic Cryoboralfs

Typical pedon: Foxton loam in an area of Sapphire-Bottle-Foxton association, 2 to 35 percent slopes; SW1/4 of sec. 4, T. 56 N., R. 89 W.

O2—3 inches to 0; partially decomposed plant material.

A2—0 to 5 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; moderate fine platy structure and moderate medium subangular blocky; friable, slightly sticky and slightly plastic; 5 percent gravel; slightly acid (pH 6.2); clear wavy boundary.

B2t—5 to 13 inches; reddish brown (5YR 4/4) clay, reddish brown (5YR 5/4) dry; moderate medium and fine prismatic structure parting to strong medium angular blocky; very firm, very sticky and very plastic; continuous thick clay films on faces of peds; 10 percent gravel; slightly acid (pH 6.4); clear wavy boundary.

B22t—13 to 26 inches; reddish brown (5YR 4/4) cobbly clay, reddish brown (5YR 5/4) dry; moderate coarse angular blocky structure; very firm, very sticky and very plastic; common moderately thick clay films on faces of peds; 5 percent gravel, 5 percent cobbles; mildly alkaline (pH 7.4); clear wavy boundary.

R—26 inches; interbedded hard noncalcareous sandstone, shale, and limestone.

Range in characteristics

A2 horizon: Color—hue - 10YR or 7.5YR, value - 5 or 6 (dry) and 4 or 5 (moist), chroma - 2 to 4; texture—loam, silt loam, sandy clay loam, clay loam; reaction—pH 5.6 to 6.5

B2t horizon: Color—hue - 10YR to 2.5YR, value - 4 to 6 (dry) and 3 or 4 (moist), chroma - 3 to 6; texture—silty clay loam, clay loam, clay, cobbly clay; reaction—pH 6.6 to 7.8

Frisco Series

The Frisco series consists of deep, well drained soils that formed in glacial till derived from granite. These soils are on moraines. The natural vegetation is mainly lodgepole pine (*Pinus contorta*) and grouse whortleberry (*Vaccinium scoparium*). Slope is 2 to 4 percent.

Taxonomic class: Loamy-skeletal, mixed Typic Cryoboralfs

Typical pedon: Frisco loam in an area of Frisco-Troutville association, 2 to 40 percent slopes; sec. 32, T. 50 N., R. 86 W.

O—2 inches to 0; needles, twigs, and partly decomposed litter.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; moderate fine granular structure; very friable, slightly sticky and slightly plastic; 5 percent gravel; medium acid (pH 6.0); abrupt wavy boundary.

A2—2 to 4 inches; brown (10YR 5/3) cobbly sandy loam, light gray (10YR 7/2) dry; weak moderate platy structure parting to weak fine subangular blocky; very friable, slightly sticky and slightly plastic; 10 percent gravel, 10 percent cobbles; medium acid (pH 5.6); clear irregular boundary.

A&B—4 to 23 inches; brown (10YR 5/3) and dark yellowish brown (10YR 4/4) very cobbly heavy sandy loam, very pale brown (10YR 7/3) dry; moderate fine subangular blocky structure; friable, slightly sticky and slightly plastic; few thin clay films on some faces of peds; 10 percent gravel, 25 percent cobbles, 10 percent stones; medium acid (pH 5.6); gradual irregular boundary.

B2t—23 to 45 inches; dark yellowish brown (10YR 4/4) very stony sandy clay loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; friable, sticky and plastic; common moderately thick clay films on faces of peds and bridging sand grains; light colored sand grains on some faces of peds; 10 percent gravel, 25 percent cobbles, 20 percent stones; medium acid (pH 5.7); clear irregular boundary.

B3—45 to 50 inches; yellowish brown (10YR 5/4) very stony heavy sandy loam, very pale brown (10YR 7/3) dry; weak fine subangular blocky structure; friable, slightly sticky and slightly plastic; few thin clay films on faces of peds; 5 percent gravel, 25 percent cobbles, 20 percent stones; medium acid (pH 5.9); clear irregular boundary.

C—50 to 60 inches; yellowish brown (10YR 5/6) extremely stony sandy loam, very pale brown (10YR 7/4) dry; single grain; loose, nonsticky and nonplastic; 20 percent gravel, 25 percent cobbles, 20 percent stones; medium acid (pH 5.9).

Range in characteristics

Profile: Depth to bedrock—60 inches or more; rock fragment content—5 to 20 percent in A horizon, 35 to 65 percent in B and C horizons (dominantly cobbles and stones)

A2 horizon: Color—value - 5 to 7 (dry) and 4 or 5 (moist), chroma - 2 or 3; reaction—pH 5.1 to 6.5

B2t horizon: Color—value - 5 or 6 (dry) and 4 or 5 (moist), chroma - 4 or 5; reaction—pH 5.1 to 6.5

Gateway Series

The Gateway series consists of moderately deep, well drained soils that formed in residuum derived from interbedded shale and sandstone. These soils are on mountainsides. The natural vegetation is mainly Engelmann spruce (*Picea engelmannii*) and grouse whortleberry (*Vaccinium scoparium*). Slope is 2 to 35 percent.

Taxonomic class: Fine, montmorillonitic Typic Cryoboralfs

Typical pedon: Gateway loam in an area of Tongue River-Gateway association, 2 to 35 percent slopes; NW1/4 of sec. 6, T. 54 N., R. 88 W.

O1—1 inch to 0; partly decomposed twigs and needles.

A1—0 to 1 inch; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine platy structure and moderate fine granular; friable, nonsticky and nonplastic; slightly acid (pH 6.4); clear wavy boundary.

A2—1 inch to 3 inches; dark grayish brown (10YR 4/2) clay loam, light brownish gray (10YR 6/2) dry; moderate medium and fine platy structure; friable, slightly sticky and slightly plastic; slightly acid (pH 6.4); gradual irregular boundary.

B&A—3 to 6 inches; grayish brown (2.5Y 5/2) clay, light brownish gray (2.5Y 6/2) dry; strong fine subangular blocky structure and weak medium platy; firm, sticky and plastic; common moderately thick clay films on faces of peds; slightly acid (pH 6.4); gradual irregular boundary.

B21t—6 to 10 inches; grayish brown (2.5Y 5/2) clay, light brownish gray (2.5Y 6/2) dry; strong medium and fine subangular blocky structure; firm, sticky and plastic; many moderately thick clay films on faces of peds; slightly acid (pH 6.4); gradual irregular boundary.

B22t—10 to 18 inches; olive (5Y 5/3) clay, pale olive (5Y 6/3) dry; strong medium and coarse subangular blocky structure; firm, very sticky and very plastic; continuous thick clay films on faces of peds; slightly acid (pH 6.4); gradual wavy boundary.

C—18 to 26 inches; olive (5Y 5/4) clay, pale olive (5Y 6/3) dry; massive; firm, sticky and plastic; neutral (pH 6.6); gradual wavy boundary.
C2r—26 to 28 inches; soft shale.

Range in characteristics
Profile: Rock fragment content—0 to 30 percent throughout
A2 horizon: Color—hue - 10YR to 2.5Y, value - 5 to 7 (dry) and 3 or 4 (moist), chroma - 1 to 4; texture—loam, clay loam, silt loam, silty clay loam; reaction—pH 5.6 to 6.5
B2t horizon: Color—hue - 7.5YR to 5Y, value - 6 or 7 (dry) and 4 or 5 (moist), chroma - 2 to 4; texture—clay loam, clay, silty clay loam, silty clay; reaction—pH 5.6 to 7.3

Granile Series

The Granile series consists of deep, well drained soils that formed in residuum derived from granite. These soils are on mountainsides. The natural vegetation is mainly lodgepole pine (*Pinus contorta*) and grouse whortleberry (*Vaccinium scoparium*). Slope is 5 to 25 percent.
Taxonomic class: Loamy-skeletal, mixed Typic Cryoboralfs
Typical pedon: Granile gravelly sandy loam in an area of Tellman-Granile-Agneston association, 2 to 20 percent slopes; sec. 26, T. 49 N., R. 84 W.

O1—1 inch to 0; partly decomposed needles and twigs.
A1—0 to 2 inches; dark yellowish brown (10YR 3/4) gravelly sandy loam, brown (10YR 5/3) dry; moderate fine granular structure; slightly sticky and slightly plastic; 5 percent gravel; medium acid (pH 5.7); clear wavy boundary.
A2—2 to 8 inches; dark yellowish brown (10YR 4/4) very gravelly coarse sandy loam, pale brown (10YR 6/3) dry; moderate fine subangular blocky structure; nonsticky and nonplastic; 25 percent gravel, 10 percent cobbles; medium acid (pH 5.9); gradual wavy boundary.
A&B—8 to 12 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) very gravelly sandy clay loam, pale brown (10YR 6/3) and light yellowish brown (10YR 6/4) dry; moderate fine and medium subangular blocky structure; slightly sticky and plastic; few thin clay films on faces of peds; 25 percent gravel, 5 percent cobbles; medium acid (pH 5.8); gradual wavy boundary.
B2t—12 to 20 inches; yellowish brown (10YR 5/4) very cobbly sandy clay loam, light yellowish brown (10YR 6/4) dry; moderate fine and medium subangular blocky structure; slightly sticky and plastic; common thin clay films on faces of peds; 25 percent gravel, 20 percent cobbles; medium acid (pH 5.8); clear wavy boundary.
C—20 to 45 inches; brown (10YR 5/3) very cobbly sandy loam, yellowish brown (10YR 5/4) dry; single grain; nonsticky and nonplastic; 10 percent gravel, 40 percent cobbles; medium acid (pH 5.7); abrupt smooth boundary.
R—45 inches; hard granite.

Range in characteristics
Profile: Depth to bedrock—40 to 60 inches; rock fragment content—35 to 55 percent in major part of the solum
A2 horizon: Color—value - 6 or 7 (dry) and 4 or 5 (moist), chroma - 2 to 4; reaction—pH 5.1 to 6.0
B2t horizon: Color—value - 5 or 6 (dry) and 4 or 5 (moist), chroma - 3 or 4; reaction—pH 5.1 to 6.0

Grobutte Series

The Grobutte series consists of deep, well drained soils that formed in colluvium derived from limestone and shale. These soils are on mountainsides and old landslide deposits. The natural vegetation is mainly bluebunch wheatgrass (*Agropyron spicatum*) and black sagebrush (*Artemisia arbuscula nova*). Slope is 8 to 60 percent.
Taxonomic class: Loamy-skeletal, mixed (calcareous), frigid Ustic Torriorthents
Typical pedon: Grobutte very gravelly loam in an area of Grobutte very gravelly loam, 8 to 60 percent slopes; NW1/4 of sec. 10, T. 53 N., R. 90 W.

A—0 to 3 inches; dark grayish brown (10YR 4/2) very gravelly loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable, slightly sticky and slightly plastic; 25 percent gravel, 10 percent cobbles; violently effervescent; moderately alkaline (pH 8.2); gradual wavy boundary.
C—3 to 10 inches; brown (10YR 5/3) very gravelly loam, very pale brown (10YR 7/3) dry; massive; friable, slightly sticky and slightly plastic; 25 percent gravel, 10 percent cobbles; violently effervescent; moderately alkaline (pH 8.2); gradual irregular boundary.
C2—10 to 41 inches; pale brown (10YR 6/3) extremely gravelly loam, very pale brown (10YR 7/3) dry; massive; friable, slightly sticky and slightly plastic; 50 percent gravel, 10 percent cobbles; violently effervescent; moderately alkaline (pH 8.2).

Range in characteristics
Profile: Depth to bedrock—60 inches or more; rock fragment content—35 to 65 percent throughout
A horizon: Color—hue - 10YR or 2.5Y, value - 4 to 6 (dry) and 3 or 4 (moist), chroma - 2 or 3; texture—loam, clay loam; reaction—pH 7.9 to 8.4

C horizon: Color—hue - 10YR to 5Y, value - 6 to 8 (dry) and 4 to 6 (moist), chroma - 3 or 4; texture—loam, clay loam; reaction—pH 7.9 to 8.4

Hanson Series

The Hanson series consists of deep, well drained soils that formed in calcareous alluvium derived from limestone. These soils are on alluvial fans, terraces, and terrace breaks. The natural vegetation is mainly Idaho fescue (*Festuca idahoensis*) and silky lupine (*Lupinus sericeus*). Slope is 0 to 30 percent.

Taxonomic class: Loamy-skeletal, carbonatic Calcic Cryoborolls

Typical pedon: Hanson very cobbly loam in an area of Hanson-Raynesford association, 0 to 30 percent slopes; SW1/4 of sec. 23, T. 56 N., R. 89 W.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) very cobbly loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; very friable, slightly sticky and slightly plastic; 20 percent gravel, 25 percent cobbles; mildly alkaline (pH 7.4); abrupt wavy boundary.

C1ca—2 to 12 inches; brown (10YR 5/3) very cobbly loam, pinkish gray (7.5YR 6/2) dry; weak fine subangular blocky structure parting to moderate very fine granular; very friable, slightly sticky and slightly plastic; 20 percent gravel, 25 percent cobbles; strongly effervescent; moderately alkaline (pH 8.0); clear wavy boundary.

C2ca—12 to 28 inches; light gray (10YR 7/2) very cobbly loam, white (10YR 8/1) dry; moderate medium subangular blocky structure parting to moderate very fine granular; very friable, slightly sticky and slightly plastic; 25 percent gravel, 5 percent cobbles; violently effervescent; lime coating gravel and disseminated throughout; moderately alkaline (pH 8.2); clear wavy boundary.

C3ca—28 to 41 inches; light gray (10YR 7/2) very cobbly loam, white (10YR 8/1) dry; moderate medium subangular blocky structure; very friable, slightly sticky and slightly plastic; 20 percent gravel, 5 percent cobbles; violently effervescent; lime coating gravel and disseminated throughout; moderately alkaline (pH 8.4).

Range in characteristics

Profile: Depth to bedrock—60 inches or more

Mollic epipedon: Thickness—8 to 12 inches

A horizon: Color—value - 3 to 5 (dry) and 2 or 3 (moist), chroma - 1 or 2; texture—very cobbly loam, gravelly loam; reaction—pH 6.6 to 7.8

Cca horizon: Color—value - —6 to 8 (dry) and 4 to 7 (moist), chroma - 1 to 3; texture—very cobbly loam, very gravelly loam, very gravelly clay loam; reaction—pH 7.9 to 9.0

Hanson Variant

The Hanson Variant consists of moderately deep, well drained soils that formed in colluvium derived from limestone. These soils are on mountainsides. The natural vegetation is mainly Idaho fescue (*Festuca idahoensis*) and bluebunch wheatgrass (*Agropyron spicatum*). Limber pine (*Pinus flexilis*) and ponderosa pine (*Pinus ponderosa*) form a very sparse overstory. Slope is 10 to 60 percent.

Taxonomic class: Loamy-skeletal, carbonatic Calcic Cryoborolls

Typical pedon: Hanson Variant very gravelly silt loam in an area of Hanson Variant-Starley association, 10 to 60 percent slopes; sec. 15, T. 58 N., R. 90 W.

A1—0 to 9 inches; very dark grayish brown (10YR 3/2) very gravelly silt loam, brown (10YR 5/3) dry; moderate medium granular structure; friable, slightly sticky and slightly plastic; 35 percent fine gravel; slightly effervescent; neutral (pH 7.2); clear wavy boundary.

C1ca—9 to 16 inches; dark brown (10YR 4/3) very gravelly loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable, slightly sticky and slightly plastic; 40 percent fine gravel; strongly effervescent; lime coatings on gravel undersides; mildly alkaline (pH 7.4); clear smooth boundary.

C2ca—16 to 24 inches; brown (10YR 5/3) very gravelly loam, very pale brown (10YR 7/3) dry; moderate fine subangular blocky structure; friable, slightly sticky and slightly plastic; 45 percent fine gravel; violently effervescent; lime coatings on gravel undersides; mildly alkaline (pH 7.6); abrupt irregular boundary.

R—24 inches; hard fractured limestone.

Range in characteristics

Mollic epipedon: Thickness—8 to 10 inches

Control section: Rock fragment content—35 to 70 percent

A1 horizon: Color—value - 4 or 5 (dry) and 2 or 3 (moist), chroma - 2 or 3; texture—silt loam, loam

*Cca horizon:*color—value - 6 or 7 (dry) and 4 to 6 (moist), chroma - 2 or 3; reaction—pH 7.4 to 7.8

Hazton Series

The Hazton series consists of shallow, well drained soils that formed in residuum derived from granite. These soils are on mountainsides and ridges. The natural vegetation is mainly Idaho fescue (*Festuca idahoensis*) and sedges (*Carex spp.*). Slope is 2 to 30 percent.

Taxonomic class: Loamy, mixed Lithic Cryoborolls

Typical pedon: Hazton gravelly sandy loam in an area of Lucky-Burgess-Hazton association, 2 to 30 percent slopes; sec. 28, T. 56 N., R. 87 W.

A1—0 to 7 inches; very dark grayish brown (10YR 3/2) gravelly sandy loam, dark brown (10YR 3/3) dry; moderate medium granular structure; friable, slightly sticky and slightly plastic; 5 percent gravel; neutral (pH 6.7); clear smooth boundary.
C—7 to 13 inches; dark yellowish brown (10YR 4/4) gravelly coarse sandy loam, yellowish brown (10YR 5/4) dry; weak medium subangular blocky structure parting to single grain; friable, nonsticky and nonplastic; 30 percent gravel; neutral (pH 6.7); abrupt smooth boundary.
R—13 inches; hard granite.

Range in characteristics
Mollic epipedon: Thickness—7 to 12 inches; rock fragment content—5 to 35 percent (fine gravel)
A1 horizon: Color—value - 3 to 6 (dry) and 2 or 3 (moist), chroma - 2 to 4; texture—gravelly sandy loam, gravelly coarse sandy loam; reaction—pH 6.1 to 7.3
C horizon: Texture—gravelly sandy loam, gravelly coarse sandy loam; reaction—pH 6.1 to 7.3

Inchau Series

The Inchau series consists of moderately deep, well drained soils that formed in residuum or alluvium derived from soft sandstone. These soils are on mountainsides and fans. The natural vegetation is mainly Idaho fescue (*Festuca idahoensis*) and sedges (*Carex spp.*). Slope is 2 to 20 percent.
Taxonomic class: Fine-loamy, mixed Argic Cryoborolls
Typical pedon: Inchau loam in an area of Inchau-Carbol association, 2 to 20 percent slopes; sec. 33, T. 56 N., R. 91 W.

A1—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; moderate medium granular structure; very friable, slightly sticky and slightly plastic; medium acid (pH 6.1); clear smooth boundary.
B1—7 to 14 inches; dark yellowish brown (10YR 3/4) clay loam, pale brown (10YR 6/3) dry; weak medium prismatic structure parting to moderate medium subangular blocky; friable, sticky and plastic; few thin clay films on faces of peds; medium acid (pH 6.1); clear smooth boundary.
B2t—14 to 20 inches; yellowish brown (10YR 5/4) clay loam, very pale brown (10YR 7/4) dry; moderate medium subangular blocky structure; friable, sticky and plastic; common moderately thick clay films on faces of peds; 5 percent gravel; medium acid (pH 6.1); clear wavy boundary.
C1—20 to 28 inches; light olive brown (2.5Y 5/4) gravelly clay loam, pale yellow (2.5Y 7/4) dry; massive; friable, sticky and plastic; 30 percent gravel; strongly acid (pH 5.5); gradual wavy boundary.
C2r—28 to 34 inches; soft noncalcareous sandstone.

Range in characteristics
Mollic epipedon: Thickness—7 to 12 inches
A horizon: Color—value - 3 to 5 (dry) and 2 or 3 (moist), chroma - 2 or 3; reaction—pH 6.1 to 6.5
B2t horizon: Color—hue - 10YR or 7.5YR, value - 4 to 7 (dry) and 4 or 5 (moist), chroma - 2 to 4; texture—clay loam, gravelly clay loam; reaction—pH 6.1 to 6.5

Leavitt Series

The Leavitt series consists of deep, well drained soils that formed in alluvium or colluvium derived from limestone. These soils are on toe slopes and fans. The natural vegetation is mainly Idaho fescue (*Festuca idahoensis*) and silky lupine (*Lupinus sericeus*). Slope is 2 to 30 percent.
Taxonomic class: Fine-loamy, mixed Argic Cryoborolls
Typical pedon: Leavitt loam in an area of Leavitt-Passcreek association, 2 to 30 percent slopes; SE1/4 of sec. 26, T. 49 N., R. 87 W.

A11—0 to 3 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to moderate fine granular; very friable, slightly sticky and slightly plastic; neutral (pH 6.6); clear smooth boundary.
A12—3 to 12 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure parting to moderate fine granular; very friable, slightly sticky and slightly plastic; neutral (pH 6.6); clear wavy boundary.
B2t—12 to 25 inches; dark brown (10YR 4/3) silty clay loam, brown (7.5YR 5/4) dry; moderate medium and fine subangular blocky structure; firm, sticky and plastic; many moderately thick clay films on faces of peds; neutral (pH 6.7); clear smooth boundary.
B3ca—25 to 30 inches; brown (7.5YR 5/4) gravelly silty clay loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; firm, sticky and plastic; 20 percent gravel; strongly effervescent; mildly alkaline (pH 7.6); clear smooth boundary.
Cca—30 to 44 inches; brown (7.5YR 5/4) gravelly silty clay loam, pale brown (10YR 6/3) dry; massive; sticky and plastic; 25 percent gravel; violently effervescent; moderately alkaline (pH 8.0).

Range in characteristics
Mollic epipedon: Thickness—10 to 15 inches
Profile: Depth to bedrock—60 inches or more; depth to calcium carbonate—7 to 30 inches
Solum: Thickness—25 to 30 inches

A horizon: Color—value - 3 or 4 (dry) and 2 or 3 (moist), chroma - 1 to 3; texture—loam, silt loam; reaction—pH 6.6 to 7.3

B2t horizon: Color—hue - 10YR or 7.5YR, value - 5 or 6 (dry) and 3 or 4 (moist), chroma - 1to 4; texture—clay loam, silty clay loam; reaction—pH 6.1 to 7.3

Cca horizon: Color—hue - 10YR or 7.5YR, value - 6 to 8 (moist), chroma - 2 to 4; texture—loam, gravelly clay loam, gravelly silty clay loam

Leighcan Series

The Leighcan series consists of deep, well drained soils that formed in colluvium or residuum derived from granite. These soils are on mountainsides. The natural vegetation is mainly Engelmann spruce (*Picea engelmannii*) and grouse whortleberry (*Vaccinium scoparium*). Slope is 5 to 30 percent.

Taxonomic class: Loamy-skeletal, mixed Dystric Cryochrepts

Typical pedon: Leighcan gravelly loam in an area of Agneston-Leighcan association, 5 to 30 percent slopes; sec. 1, T. 48 N., R. 86 W.

O1—1 inch to 0; needles and twigs.

A1—0 to 3 inches; very dark brown (10YR 2/2) gravelly loam, dark grayish brown (10YR 4/2) dry; moderate fine and medium granular structure; friable, slightly sticky and slightly plastic; 15 percent gravel; medium acid (pH 6.0); clear smooth boundary.

A2—3 to 6 inches; brown (10YR 4/3) gravelly loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure parting to fine granular; very friable, slightly sticky and slightly plastic; 15 percent gravel; medium acid (pH 5.8); clear smooth boundary.

B2—6 to 20 inches; dark yellowish brown (10YR 4/6) cobbly coarse sandy loam, very pale brown (10YR 7/4) dry; weak medium subangular blocky structure parting to single grain; loose, nonsticky and nonplastic; 5 percent gravel, 20 percent cobbles; strongly acid (pH 5.5); gradual smooth boundary.

B22—20 to 30 inches; brown (10YR 4/3) very cobbly sandy loam, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure parting to single grain; loose, nonsticky and nonplastic; 15 percent gravel, 25 percent cobbles; strongly acid (pH 5.5); gradual smooth boundary.

C1—30 to 42 inches; very dark grayish brown (10YR 3/2) very cobbly sand, brown (10YR 5/3) dry; single grain; loose, nonsticky and nonplastic; 5 percent gravel, 35 percent cobbles, 5 percent stones; medium acid (pH 5.6); abrupt irregular boundary.

R—42 inches; hard fractured gneiss and hornblende schist.

Range in characteristics

Profile: Depth to bedrock—40 to 60 inches

A2 horizon: Color—value - 5 or 6 (dry) and 4 or 5 (moist), chroma - 2 or 3; texture—loam, gravelly loam, cobbly loam, gravelly coarse sandy loam; reaction—pH 5.1 to 6.0

B2 horizon: Color—value - 6 or 7 (dry) and 4 or 5 (moist), chroma - 3 to 6; texture—cobbly coarse sandy loam, very cobbly sandy loam; reaction—pH 5.1 to 5.5

Lucky Series

The Lucky series consists of moderately deep, well drained soils that formed in residuum derived from granite. These soils are on mountainsides. The natural vegetation is mainly Idaho fescue (*Festuca idahoensis*) and sedges (*Carex spp.*). Slope is 2 to 30 percent.

Taxonomic class: Fine-loamy, mixed Argic Cryoborolls

Typical pedon: Lucky gravelly loam in an area of Lucky-Burgess-Hazton association, 2 to 30 percent slopes; sec. 17, T. 55 N., R. 88 W.

A1—0 to 7 inches; very dark grayish brown (10YR 3/2) gravelly loam, dark brown (10YR 4/3) dry; weak medium and fine granular structure; soft, very friable, slightly sticky and slightly plastic; 5 percent gravel; slightly acid (pH 6.4); clear wavy boundary.

B—7 to 13 inches; dark brown (10YR 3/3) gravelly heavy sandy loam, dark yellowish brown (10YR 4/4) dry; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few thin clay films on faces of peds; 10 percent gravel, 5 percent cobbles; medium acid (pH 6.0); clear wavy boundary.

B2t—13 to 20 inches; brown (10YR 4/3) gravelly sandy clay loam, yellowish brown (10YR 5/6) dry; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few thin clay films on faces of peds; 30 percent gravel; medium acid (pH 6.0); gradual wavy boundary.

C—20 to 30 inches; dark yellowish brown (10YR 4/4) very gravelly coarse sandy loam, strong brown (7.5YR 5/6) dry; single grain; loose, nonsticky and nonplastic; 40 percent gravel; medium acid (pH 6.0); abrupt smooth boundary.

R—30 inches; hard granite.

Range in characteristics

Mollic epipedon: Thickness—7 to 15 inches; rock fragment content—5 to 35 percent in control section

A horizon: Texture—gravelly loam, sandy loam; reaction—pH 5.6 to 7.3

B2t horizon: Color—value - 4 to 6 (dry) and 3 or 4 (moist), chroma - 3 to 6; reaction—pH 5.6 to 7.3

Mirror Series

The Mirror series consists of moderately deep, well drained soils that formed in colluvium or residuum derived from granite. These soils are on mountainsides and toe slopes. The natural vegetation is mainly an alpine plant community. Slope is 2 to 20 percent.

Taxonomic class: Loamy-skeletal, mixed Pergelic Cryumbrepts

Typical pedon: Mirror cobbly loam in an area of Mirror-Teewinot-Bross association, 2 to 40 percent slopes; SW1/4 of sec. 20, T. 50 N., R. 86 W.

A1—0 to 10 inches; very dark grayish brown (10YR 3/2) cobbly loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; very friable, slightly sticky and slightly plastic; 10 percent gravel, 10 percent cobbles, 5 percent stones; very strongly acid (pH 5.0); clear wavy boundary.

B—10 to 22 inches; dark yellowish brown (10YR 4/4) very cobbly loam, light yellowish brown (10YR 6/4) dry; moderate fine and very fine subangular blocky structure; very friable, slightly sticky and slightly plastic; 20 percent gravel, 15 percent cobbles, 5 percent stones; very strongly acid (pH 4.7); clear wavy boundary.

B2—22 to 33 inches; yellowish brown (10YR 5/4) very cobbly loam, light yellowish brown (10YR 6/4) dry; weak fine subangular blocky structure; friable, sticky and plastic; 20 percent gravel, 20 percent cobbles; very strongly acid (pH 4.7); abrupt wavy boundary.

R—33 inches; hard fractured granite.

Range in characteristics

Umbric epipedon: Thickness—8 to 12 inches

*Control section:*rock fragment content—35 to 60 percent

A1 horizon: Color—hue - 10YR or 7.5YR, value - 3 to 5 (dry) and 2 or 3 (moist), chroma - 2 to 4; texture—sandy loam, loam, coarse sandy loam; reaction—pH 4.5 to 5.5 *B2 horizon;* color—hue - 10YR or 7.5YR, value - 4 to 6 (dry) and 3 or 4 (moist), chroma - 3 or 4; texture—sandy loam, loam; reaction—pH 4.5 to 5.5

Nathrop Series

The Nathrop series consists of moderately deep, well drained soils that formed in residuum and alluvium derived from limestone. These soils are on mountainsides. The natural vegetation is mainly Idaho fescue (*Festuca idahoensis*) and silky lupine (*Lupinus sericeus*). Slope is 2 to 30 percent.

Taxonomic class: Loamy-skeletal, mixed Argic Cryoborolls

Typical pedon: Nathrop loam in an area of Nathrop-Passcreek-Starley association, 2 to 30 percent slopes; SE1/4 of sec. 28, T. 54 N., R. 85 W.

A1—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; strong fine and medium granular structure; friable, slightly sticky and slightly plastic; neutral (pH 6.6); clear wavy boundary.

B2t—8 to 14 inches; dark brown (10YR 3/3) very cobbly clay loam, brown (10YR 4/3) dry; moderate medium and fine subangular blocky structure; friable, slightly sticky and slightly plastic; common moderately thick clay films on faces of peds; 10 percent gravel, 30 percent cobbles; neutral (pH 6.8); clear wavy boundary.

B3ca—14 to 23 inches; dark yellowish brown (10YR 4/4) very cobbly clay loam, yellowish brown (10YR 5/4) dry; weak fine and medium subangular blocky structure; firm, slightly sticky and plastic; common moderately thick clay films on faces of peds and pores; 40 percent cobbles; strongly effervescent; mildly alkaline (pH 7.5); clear wavy boundary.

Cca—23 to 38 inches; yellowish brown (10YR 5/4) very cobbly clay loam, light yellowish brown (10YR 6/4) dry; massive; firm, slightly sticky and plastic; 45 percent cobbles; violently effervescent; lime in nodules, in filaments, and as coatings on rock fragments; mildly alkaline (pH 7.5); abrupt wavy boundary.

R—38 inches; hard fractured limestone.

Range in characteristics

Mollic epipedon: Thickness—9 to 15 inches

Profile: Depth to calcium carbonate—9 to 23 inches; rock fragment content—35 to 50 percent in B and C horizons

Solum: Thickness—5 to 33 inches

A horizon: Color—hue - 10YR or 7.5YR, value - 4 or 5 (dry) and 2 or 3 (moist), chroma - 1 to 3; texture—loam, silt loam; reaction—pH 6.6 to 7.3

B2t horizon: Color—hue - 10YR to 5YR, value - 4 or 5 (dry) and 3 or 4 (moist), chroma - 2 to 4; texture—silty clay loam, clay loam; reaction—pH 6.6 to 7.8

Cca horizon: Hue—10YR or 7.5YR; texture—silt loam, silty clay loam, clay loam; reaction—pH 6.6 to 8.4

Nathrop Variant

The Nathrop Variant consists of moderately deep, well drained soils that formed in residuum derived from interbedded noncalcareous and calcareous sandstone. These soils are on mountainsides and toe slopes. The natural vegetation is mainly Idaho fescue (*Festuca idahoensis*) and silky lupine (*Lupinus sericeus*). Slope is 5 to 20 percent.

Taxonomic class: Loamy-skeletal, mixed Argic Cryoborolls

Typical pedon: Nathrop Variant channery very fine sandy loam in an area of Nathrop Variant-Nielsen-

Passcreek association, 2 to 35 percent slopes; NE1/4 of sec. 3, T. 57 N., R. 90 W.

A1—0 to 7 inches; very dark brown (10YR 2/2) channery very fine sandy loam, grayish brown (10YR 5/2) dry; weak very fine granular structure parting to single grain; very friable, slightly sticky and slightly plastic, 20 percent channery fragments; slightly acid (pH 6.4); clear smooth boundary.

B2t—7 to 14 inches; brown (10YR 4/3) very channery fine sandy clay loam, brown (10YR 5/3) dry; moderate medium and coarse subangular blocky structure; friable, slightly sticky and slightly plastic; few thin clay films bridging sand grains; 35 percent channery fragments; neutral (pH 6.7); clear smooth boundary.

B22t—14 to 22 inches; yellowish brown (10YR 5/4) very channery fine sandy clay loam, light yellowish brown (10YR 6/4) dry; moderate fine and medium subangular blocky structure; firm, slightly sticky and plastic; common thin clay films on faces of peds and in pores; 65 percent channery fragments; neutral (pH 6.8); abrupt smooth boundary.

R—22 inches; hard fine grained noncalcareous sandstone with some calcareous strata.

Range in characteristics

Mollic epipedon: Thickness—7 to 8 inches

B2t horizon: Color—value - 4 to 6 (dry) and 3 to 5 (moist), chroma - 3 or 4; texture—fine sandy clay loam, clay loam; reaction—pH 6.6 to 7.8; rock fragment content—35 to 65 percent

Nielsen Series

The Nielsen series consists of shallow, well drained soils that formed in residuum derived from calcareous sandstone. These soils are on mountainsides and ridges. The natural vegetation is mainly Idaho fescue (*Festuca idahoensis*) and silky lupine (*Lupinus sericeus*). Slope is 5 to 20 percent.

Taxonomic class: Loamy-skeletal, mixed Argic Lithic Cryoborolls

Typical pedon: Nielsen channery loam in an area of Nathrop Variant-Nielsen-Passcreek association, 2 to 35 percent slopes; SE1/4 of sec. 11, T. 57 N., R. 90 W.

A11—0 to 6 inches; very dark grayish brown (10YR 3/2) channery loam, dark brown (10YR 3/3) dry; moderate medium and coarse subangular blocky structure parting to weak fine granular; very friable, slightly sticky and slightly plastic; 20 percent channery fragments; slightly acid (pH 6.4); clear smooth boundary.

A12—6 to 10 inches; dark brown (10YR 3/3) channery loam, brown (10YR 4/3) dry; moderate medium and fine subangular blocky structure; very friable, slightly sticky and slightly plastic; few thin clay films bridging sand grains; 25 percent channery fragments; neutral (pH 6.6); clear smooth boundary.

B2t—10 to 18 inches; dark grayish brown (10YR 4/2) very channery clay loam, brown (10YR 5/3) dry; moderate medium and fine subangular blocky structure; friable, slightly sticky and slightly plastic; common thin clay films bridging sand grains; 55 percent channery fragments; neutral (pH 7.0); abrupt irregular boundary.

R—18 inches; hard calcareous sandstone.

Range in characteristics

Mollic epipedon: Thickness—5 to 10 inches

A horizon: Color—value - 3 or 4 (dry) and 2 or 3 (moist), chroma - 2 or 3; texture—loam, very fine sandy loam; reaction—pH 6.1 to 7.3

B2t horizon: Color—value - 5 or 6 (dry) and 4 or 5 (moist), chroma - 2 to 4; texture—sandy clay loam, clay loam; reaction—pH 6.6 to 7.8; rock fragment content—40 to 55 percent channery fragments

Owen Creek Series

The Owen Creek series consists of moderately deep, well drained soils that formed in colluvium derived from interbedded shale and limestone. These soils are on landslide deposits and mountainsides. The natural vegetation is mainly big sagebrush (*Artemisia tridentata*) and Idaho fescue (*Festuca idahoensis*). Slope is 2 to 35 percent.

Taxonomic class: Fine, montmorillonitic Argic Cryoborolls

Typical pedon: Owen Creek clay loam in an area of Owen Creek-Waybe association, 5 to 35 percent slopes; SE1/4 of sec. 26, T. 54 N., R. 89 W.

A1—0 to 4 inches; very dark gray (N 3/0) clay loam, dark gray (N 4/0) dry; moderate medium platy structure and strong medium and fine granular; friable, sticky and plastic; neutral (pH 7.2); gradual, irregular boundary.

B21t—4 to 10 inches; dark olive gray (5Y 3/2) clay, dark gray (5Y 4/1) dry; strong medium and fine angular blocky structure; firm, sticky and plastic; common moderately thick clay films on faces of peds; mildly alkaline (pH 7.4); gradual irregular boundary.

B22t—10 to 17 inches; olive gray (5Y 4/2) clay, gray (5Y 6/1) dry; strong medium subangular blocky structure; firm, sticky and plastic; continuous thick clay films on faces of peds; mildly alkaline (pH 7.4); gradual wavy boundary.

C1—17 to 24 inches; gray (5Y 5/1) channery clay, gray (5Y 6/1) dry; massive; firm, sticky and plastic, 25 percent channery fragments; slightly effervescent; mildly alkaline (pH 7.6); gradual wavy boundary.

C2r—24 inches; soft interbedded shale and limestone.

Range in characteristics
Mollic epipedon: Thickness—8 to 15 inches
Profile: Depth to calcium carbonate—15 to 36 inches
Solum: Thickness—17 to 36 inches
A horizon: Color—hue - 2.5Y to 7.5YR, value - 3 to 5 (dry) and 2 or 3 (moist), chroma - neutral to 3; texture—clay loam, silty clay loam, silt loam, loam, reaction—pH 6.1 to 7.8

Passcreek Series

The Passcreek series consists of moderately deep, well drained soils that formed in residuum or alluvium derived from limestone. These soils are on mountainsides and fans. The natural vegetation is mainly Idaho fescue (*Festuca idahoensis*) and silky lupine (*Lupinus sericeus*). Slope is 2 to 30 percent.

Taxonomic class: Fine-loamy, mixed Argic Cryoborolls

Typical pedon: Passcreek loam in an area of Nathrop-Passcreek-Starley association, 2 to 30 percent slopes; SE1/4 of sec. 33, T. 49 N., R. 83 W.

A1—0 to 7 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; moderate fine and medium granular structure; friable, nonsticky and slightly plastic; neutral (pH 7.0); clear wavy boundary.
B2t—7 to 12 inches; dark yellowish brown (10YR 3/4) clay loam, brown (10YR 4/3) dry; strong fine and medium subangular blocky structure; friable, sticky and plastic; many thin clay films on faces of peds; 10 percent gravel; neutral (pH 7.3); clear wavy boundary.
B3ca—12 to 19 inches; brown (10YR 4/3) gravelly clay loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; very friable, slightly sticky and slightly plastic; 20 percent gravel; strongly effervescent; few lime filaments; mildly alkaline (pH 7.7); clear wavy boundary.
Cca—19 to 30 inches; brown (10YR 5/3) very gravelly loam, very pale brown (10YR 7/3) dry; massive; friable, slightly sticky and slightly plastic; 35 percent gravel; violently effervescent; lime in seams and as coatings; moderately alkaline (pH 8.0); abrupt wavy boundary.
R—30 inches; hard limestone.

Range in characteristics
Mollic epipedon: 7 to 12 inches thick
Profile: depth to calcium carbonate—9 to 18 inches; rock fragment content—0 to 25 percent in solum, 35 to 60 percent in C horizon
A1 horizon: Color—value - 3 or 4 (dry) and 2 or 3 (moist), chroma - 2 or 3; texture—loam, silt loam; reaction—pH no. 1 to 7.3
B2t horizon: Color—value - 4 or 5 (dry) and 3 or 4 (moist), chroma - 3 or 4; texture—clay loam, silty clay loam; reaction—pH 6.6 to 7.3
Cca horizon: color—value - 6 or 7 (dry) and 5 or 6 (moist), chroma - 3 or 4; texture—loam, clay loam, silty clay loam

Pishkun Series

The Pishkun series consists of deep, well drained soils that formed in calcareous stony colluvium derived from limestone. These soils are on old landslide deposits. The natural vegetation is mainly big sagebrush (*Artemisia tridentata*) and Idaho fescue (*Festuca idahoensis*). Slope is 5 to 40 percent.

Taxonomic class: Loamy-skeletal, mixed (calcareous) Typic Cryorthents

Typical pedon: Pishkun very gravelly loam in an area of Farlow-Pishkun association, 5 to 40 percent slopes; NW1/4 of sec. 8, T. 53 N., R. 89 W.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) very gravelly loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; very friable, nonsticky and slightly plastic; 30 percent gravel, 10 percent cobbles; slightly effervescent; mildly alkaline (pH 7.6); gradual irregular boundary.
AC—3 to 7 inches; dark grayish brown (10YR 4/2) very gravelly loam, pale brown (10YR 6/3) dry; weak medium and fine subangular blocky structure; very friable, slightly sticky and slightly plastic; 30 percent gravel, 10 percent cobbles; violently effervescent; moderately alkaline (pH 8.2); gradual wavy boundary.
Cca—7 to 42 inches; yellowish brown (10YR 5/4) extremely gravelly clay loam, very pale brown (10YR 7/3) dry; massive; very friable, slightly sticky and slightly plastic; 50 percent gravel, 15 percent cobbles; violently effervescent; moderately alkaline (pH 8.4).

Range in characteristics
Profile: Depth to bedrock—60 inches or more
Control section: Rock fragment content—50 to 65 percent
A1 horizon: Texture—gravelly loam, very gravelly loam; reaction—pH 7.4 to 7.8
Cca horizon: Color—hue - 10YR to 2.5Y; texture—loam, clay loam; reaction—pH 7.9 to 8.4

Raynesford Series

The Raynesford series consists of deep, well drained soils that formed in calcareous alluvium derived from limestone. These soils are on fans and terraces. The natural vegetation is mainly Idaho fescue (*Festuca*

idahoensis) and silky lupine (*Lupinus sericeus*). Slope is 0 to 30 percent.

Taxonomic class: Fine-loamy, carbonatic Calcic Cryoborolls

Typical pedon: Raynesford loam in an area of Hanson-Raynesford association, 0 to 30 percent slopes; NW1/4 of sec. 34, T. 56 N., R. 89 W.

A1—0 to 12 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; moderate medium granular structure; very friable, slightly sticky and slightly plastic; 5 percent gravel; neutral (pH 7.2); abrupt wavy boundary.

C1ca—12 to 21 inches; brown (10YR 5/3) loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure parting to moderate medium granular; very friable, slightly sticky and slightly plastic; 5 percent gravel; strongly effervescent; mildly alkaline (pH 7.6); clear wavy boundary.

C2ca—21 to 31 inches; very pale brown (10YR 7/3) gravelly loam, white (10YR 8/1) dry; moderate fine subangular blocky structure; friable, sticky and slightly plastic; 15 percent gravel, 5 percent cobbles; violently effervescent; calcium carbonate disseminated throughout and as coatings on undersides of gravel; moderately alkaline (pH 8.4); clear wavy boundary.

C3ca—31 to 41 inches; very pale brown (10YR 7/3) very cobbly loam, white (10YR 8/2) dry; weak fine subangular blocky structure; friable, sticky and slightly plastic; 20 percent gravel, 20 percent cobbles; violently effervescent; lime disseminated throughout; moderately alkaline (pH 8.2).

Range in characteristics

Profile: Depth to bedrock—60 inches or more

Mollic epipedon: Thickness—12 to 15 inches

Profile: Rock fragment content—10 to 25 percent throughout, 35 to 40 percent in lower part of Cca horizon

A1 horizon: Color—value - 3 or 4 (dry) and 2 or 3 (moist), chroma - 1 or 2; texture—loam, gravelly loam

Cca horizon: Color—value - 7 or 8 (dry) and 5 to 7 (moist), chroma - 1 to 4; texture—loam, clay loam, sandy clay loam

Sapphire Series

The Sapphire series consists of moderately deep, well drained soils that formed in residuum derived from light brown sandstone. These soils are on mountainsides. The natural vegetation is mainly lodgepole pine (*Pinus contorta*) and grouse whortleberry (*Vaccinium scoparium*). Slope is 5 to 35 percent.

Taxonomic class: Fine-loamy, mixed Typic Cryoboralfs

Typical pedon: Sapphire fine sandy loam in an area of Sapphire-Bottle-Foxton association, 2 to 35 percent slopes; NE1/4 of sec. 14, T. 56 N., R. 89 W.

O1—1 inch to 0; scattered leaf and twig litter.

A21—0 to 7 inches; brown (10YR 5/3) fine sandy loam, light brownish gray (10YR 6/2) dry; moderate medium and fine platy structure; very friable, slightly sticky and slightly plastic; 10 percent channery fragments; slightly acid (pH 6.2); clear smooth boundary.

A22—7 to 13 inches; yellowish brown (10YR 5/4) fine sandy loam, very pale brown (10YR 7/4) dry; moderate fine subangular blocky structure; very friable, slightly sticky and slightly plastic; 5 percent channery fragments; slightly acid (pH 6.1); clear wavy boundary.

A&B—13 to 23 inches; yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) sandy clay loam, very pale brown (10YR 7/3) dry; single grain and strong medium subangular blocky structure; friable, sticky and plastic; few moderately thick clay films on faces of peds; 10 percent channery fragments; slightly acid (pH 6.4); clear wavy boundary.

B2t—23 to 31 inches; yellowish brown (10YR 5/4) channery sandy clay loam, yellowish brown (10YR 5/6) dry; strong medium subangular blocky structure; firm, very sticky and very plastic; many moderately thick clay films on faces of peds; some bleached sand grains; 20 percent channery fragments; neutral (pH 6.6); clear wavy boundary.

R—31 inches; hard noncalcareous sandstone.

Range in characteristics

Profile: Rock fragment content—5 to 20 percent throughout

A2 horizon: Color—value - 4 or 5 (moist), chroma - 2 to 4; texture—fine sandy loam, very fine sandy loam; reaction—pH 6.1 to 6.5

B2t horizon: Texture—sandy clay loam, channery sandy clay loam; reaction—pH 6.1 to 7.3

Spearfish Variant

The Spearfish Variant consists of shallow, well drained soils that formed in residuum derived from red shale and sandstone. These soils are on mountainsides. The natural vegetation is mainly Utah juniper (*Juniperus osteosperma*) and big sagebrush (*Artermisia tridentata*). Slope is 5 to 40 percent.

Taxonomic class: Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents

Typical pedon: Spearfish Variant gravelly loam in an area of Chilton Variant-Sunup-Spearfish Variant association, 5 to 60 percent slopes; SW1/4 of sec. 5, T. 53 N., R. 90 W.

A1—0 to 4 inches; reddish brown (2.5YR 4/4) gravelly loam, light reddish brown (2.5YR 6/4) dry; strong medium and fine platy structure and moderate fine granular; friable, slightly sticky and slightly plastic; 20

percent gravel; violently effervescent; moderately alkaline (pH 8.2); gradual wavy boundary.
C1—4 to 14 inches; red (2.5YR 4/6) loam, red (2.5YR 5/6) dry; massive; friable, slightly sticky and slightly plastic; violently effervescent; moderately alkaline (pH 8.2); gradual wavy boundary.
C2r—14 inches; soft interbedded shale and sandstone.

Range in characteristics

Control section: Texture—loam, gravelly loam

Profile: Rock fragment content—5 to 20 percent gravel throughout

A1 horizon: Color—value - 5 or 6 (dry) and 3 or 4 (moist), chroma - 4 to 6; reaction—pH 7.9 to 8.4

C horizon: Color—value - 5 or 6 (dry) and 4 or 5 (moist), chroma - 4 to 6; reaction—pH 7.9 to 8.4

Starley Series

The Starley series consists of shallow, well drained soils that formed in colluvium and residuum derived from limestone. These soils are on windswept mountainsides and ridges. The natural vegetation is mainly an association of Idaho fescue (*Festuca idahoensis*) and sedges (*Carex spp.*). Slope is 2 to 40 percent.

Taxonomic class: Loamy-skeletal, mixed Lithic Cryoborolls

Typical pedon: Starley loam in an area of Starman-Starley association, 2 to 30 percent slopes; sec. 32, T. 55 N., R. 90 W.

A1—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry, weak medium platy structure parting to moderate medium and fine subangular blocky; friable, slightly sticky and slightly plastic; 5 percent gravel; mildly alkaline (pH 7.4); gradual irregular boundary.
C—8 to 15 inches; brown (10YR 4/3) extremely cobbly loam, yellowish brown (10YR 5/4) dry; massive; friable, slightly sticky and slightly plastic; 20 percent gravel, 40 percent cobbles, 10 percent stones; slightly effervescent; mildly alkaline (pH 7.8); abrupt wavy boundary.
R—15 inches; hard fractured limestone.

Range in characteristics

Mollic epipedon: Thickness—5 to 14 inches

Control section: Rock fragment content—35 to 70 percent

A1 horizon: Hue—10YR or 7.5YR, value - 4 or 5 (dry) and 2 or 3 (moist), chroma - 1 to 3; reaction—pH 6.6 to 7.8

C horizon: Color—hue - 10YR or 7.5YR, value - 5 to 7 (dry) and 3 to 6 (moist), chroma - 2 to 4; texture—loam, silt loam, silty clay loam; reaction—pH 6.6 to 8.4

Starman Series

The Starman series consists of shallow, well drained soil that formed in residuum derived from limestone. These soils are on back slopes and ridges. The natural vegetation is mainly Idaho fescue (*Festuca idahoensis*) and sedges (*Carex spp.*). Slope is 5 to 70 percent.

Taxonomic class: Loamy-skeletal, mixed (calcareous) Lithic Cryorthents

Typical pedon: Starman channery clay loam in an area of Starman-Starley association, 2 to 30 percent slopes; NE1/4 of sec. 15, T. 54 N., R. 89 W.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) channery clay loam, pale brown (10YR 6/3) dry; strong fine granular structure; friable, slightly sticky and slightly plastic; 30 percent channery fragments; slightly effervescent; mildly alkaline (pH 7.6); gradual wavy boundary.
C—3 to 15 inches; grayish brown (10YR 5/2) extremely channery clay loam, light gray (10YR 7/2) dry; massive; friable, slightly sticky and slightly plastic; 65 percent channery fragments; strongly effervescent; moderately alkaline (pH 7.9); abrupt wavy boundary.
R—15 inches; hard fractured limestone.

Range in characteristics

Control section: Rock fragment content—35 to 65 percent

A1 horizon: Color—value - 5 to 7 (dry) and 3 or 4 (moist), chroma - 2 or 3; texture—loam, clay loam; reaction—pH 7.4 to 8.4; rock fragment content—0 to 30 percent

C horizon: Texture—loam, clay loam; reaction—pH 7.9 to 8.4

Starman Variant

The Starman Variant consists of shallow, well drained soils that formed in residuum derived from limestone. These soils are on the back slopes of limestone escarpments. The natural vegetation is mainly mountainmahogany (*Cercocarpus ledifolius*) and bluebunch wheatgrass (*Agropyron spicatum*). Slope is 10 to 70 percent.

Taxonomic class: Loamy-skeletal, mixed (calcareous), frigid Lithic Ustic Torriorthents

Typical pedon: Starman Variant very channery loam in an area of Rock outcrop-Starman Variant association, 10 to 70 percent slopes; SE1/4 of sec. 31, T. 54 N., R. 90 W.

A1—0 to 2 inches; brown (10YR 4/3) very channery loam, pale brown (10YR 6/3) dry; weak medium and fine granular structure; friable, slightly sticky and slightly plastic; 55 percent channery fragments; strongly effervescent; mildly alkaline (pH 7.8); clear wavy boundary.

C—2 to 11 inches; brown (7.5YR 4/4) extremely channery loam, light brown (7.5YR 6/4) dry; massive; friable, slightly sticky and slightly plastic; 70 percent channery fragments; violently effervescent; moderately alkaline (pH 8.0); abrupt wavy boundary.

R—11 inches; hard limestone.

Range in characteristics

Profile: Rock fragment content—35 to 70 percent throughout

A1 horizon: Color—value - 5 or 6 (dry) and 3 or 4 (moist), chroma - 2 or 3; reaction—pH 7.4 to 8.4

C horizon: Color—hue - 10YR or 7.5YR; texture—loam, clay loam; reaction—pH 7.4 to 8.4

Sunup Series

The Sunup series consists of shallow, well drained soils that formed in residuum derived from limestone. These soils are on mountainsides. The natural vegetation is mainly Utah juniper (*Juniperus osteosperma*) and big sagebrush (*Artemisia tridentata*). Slope is 5 to 50 percent.

Taxonomic class: Loamy-skeletal, mixed (calcareous), mesic Lithic Ustic Torriorthents

Typical pedon: Sunup very stony fine sandy loam in an area of Chilton Variant-Sunup-Spearfish Variant association, 5 to 60 percent slopes; NW1/4 of sec. 16, T. 53 N., R. 90 W.

A1—0 to 4 inches; brown (7.5YR 5/4) very stony fine sandy loam, light brown (7.5YR 6/4) dry; weak medium and fine platy structure; very friable, slightly sticky and slightly plastic; 10 percent gravel, 25 percent cobbles, 25 percent stones; strongly effervescent; moderately alkaline (pH 8.0); gradual irregular boundary.

C—4 to 10 inches; light brown (7.5YR 6/4) very stony fine sandy loam, pink (7.5YR 7/4) dry; weak medium subangular blocky structure; very friable, slightly sticky and slightly plastic; 10 percent gravel, 25 percent cobbles, 20 percent stones; strongly effervescent; moderately alkaline (pH 8.2); abrupt irregular boundary.

R—10 inches; hard cherty limestone.

Range in characteristics

Profile: Rock fragment content—35 to 65 percent throughout

A1 horizon: Color—hue - 10YR or 7.5YR, value - 5 or 6 (dry) and 4 or 5 (moist), chroma - 4 to 6; texture—loam, fine sandy loam

C horizon: Color—hue - 10YR or 7.5YR; texture—loam, fine sandy loam; reaction—pH 7.9 to 8.4

Teewinot Series

The Teewinot series consists of shallow, well drained soils that formed in residuum derived from granite. These soils are on ridgetops and mountainsides. The natural vegetation is mainly an alpine plant community. Slope is 5 to 40 percent.

Taxonomic class: Loamy-skeletal, mixed Lithic Cryumbrepts

Typical pedon: Teewinot very cobbly loam in an area of Mirror-Teewinot-Bross association, 2 to 40 percent slopes; SW1/4 of sec. 17, T. 50 N., R. 86 W.

A1—0 to 8 inches; very dark grayish brown (10YR 3/2) very cobbly loam, brown (10YR 4/3) dry; moderate very fine granular structure; very friable, slightly sticky and slightly plastic; 10 percent gravel, 20 percent cobbles, 10 percent stones; strongly acid (pH 5.4); clear wavy boundary.

B2—8 to 17 inches; dark yellowish brown (10YR 4/4) very cobbly loam, yellowish brown (10YR 5/4) dry; weak fine subangular blocky structure parting to moderate fine granular; very friable, slightly sticky and slightly plastic; 10 percent gravel, 20 percent cobbles, 10 percent stones; strongly acid (pH 5.2); abrupt wavy boundary.

R—17 inches; hard fractured granite.

Range in characteristics:

Umbric epipedon: Thickness—7 to 8 inches

Profile: Rock fragment content—35 to 75 percent gravel, cobbles, and stones

A1 horizon: Color—value - 3 or 4 (moist) and 2 or 3 (dry), chroma - 2 or 3; texture—loam, sandy loam; reaction—pH 5.1 to 6.0

B2 horizon: Color—value - 4 or 5 (moist) and 3 or 4 (dry), chroma - 2 to 4; texture—loam, sandy loam; reaction—pH 5.1 to 6.0

Tellman Series

The Tellman series consists of deep, well drained soils that formed in alluvium or residuum derived from granite. These soils are on mountainsides, fans, and outwash plains. The natural vegetation is mainly lodgepole pine (*Pinus contorta*) and grouse whortleberry (*Vaccinium scoparium*). Slope is 2 to 20 percent.

Taxonomic class: Fine-loamy over sandy or sandy-skeletal, mixed Typic Cryoboralfs

Typical pedon: Tellman sandy loam in an area of Tellman-Granile-Agneston association, 2 to 20 percent slopes; sec. 7, T. 47 N., R. 84 W.

O1—2 inches to 0; undecomposed pine needles and twigs.

A1—0 to 1 inch; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable, slightly sticky and

slightly plastic; 10 percent gravel; strongly acid (pH 5.2); abrupt wavy boundary.

A2—1 to 7 inches; brown (10YR 4/3) gravelly coarse sandy loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; very friable, nonsticky and nonplastic; 20 percent gravel; strongly acid (pH 5.4); clear wavy boundary.

A&B—7 to 10 inches; dark yellowish brown (10YR 4/4) gravelly coarse sandy loam and gravelly sandy clay loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; friable, nonsticky and nonplastic; 20 percent gravel; strongly acid (pH 5.2); gradual wavy boundary.

B2t—10 to 17 inches; brown (7.5YR 4/4) gravelly sandy clay loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; very friable, slightly sticky and slightly plastic; many thin and moderately thick clay films on faces of peds and in pores; 20 percent gravel; strongly acid (pH 5.2); clear wavy boundary.

B3t—17 to 35 inches; dark yellowish brown (10YR 4/4), gravelly sandy clay loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; friable, nonsticky and nonplastic; few thin clay films on faces of peds; 20 percent gravel; medium acid (pH 5.7); gradual wavy boundary.

IIC—35 to 60 inches; yellowish brown (10YR 5/4) loamy coarse sand, very pale brown (10YR 7/4) dry; single grain; loose, nonsticky and nonplastic; 10 percent gravel; slightly acid (pH 6.2).

Range in characteristics

Profile: Depth to bedrock—60 inches or more; rock fragment content—5 to 20 percent in solum

A2 horizon: Color—hue - 10YR or 7.5YR, value - 4 to 6 (dry) and 3 or 4 (moist), chroma - 2 to 4; texture—sandy loam, gravelly sandy loam; reaction—pH 4.5 to 5.5

B2t horizon: Color—hue - 10YR or 7.5YR, value - 5 or 6 (dry) and 4 or 5 (moist), chroma - 4 or 5; texture—sandy clay loam, gravelly sandy clay loam; reaction—pH 5.1 to 5.5

IIC horizon: Depth from surface—20 to 40 inches; texture—loamy coarse sand, gravelly loamy coarse sand; reaction—pH 5.1 to 6.5

Tine Series

The Tine series consists of deep, somewhat excessively drained soils that formed in glacial till derived from granite. These soils are on moraines. The natural vegetation is mainly big sagebrush (*Artemisia tridentata*) and Idaho fescue (*Festuca idahoensis*). Slope is 2 to 20 percent.

Taxonomic class: Sandy-skeletal, mixed Typic Cryoborolls

Typical pedon: Tine very cobbly loam in an area of Tine-Fourmile association, 2 to 30 percent slopes; SW1/4 of sec. 6, T. 48 N., R. 86 W.

A1—0 to 9 inches; very dark grayish brown (10YR 3/2) very cobbly loam, dark grayish brown (10YR 4/2) dry; moderate very fine granular structure; friable, slightly sticky and slightly plastic; 5 percent gravel, 25 percent cobbles, 10 percent stones; slightly acid (pH 6.4); clear wavy boundary.

C1—9 to 14 inches; dark brown (10YR 4/3) very cobbly sandy loam, brown (10YR 5/3) dry; weak medium granular structure; very friable, slightly sticky and slightly plastic; 15 percent gravel, 25 percent cobbles, 15 percent stones; slightly acid (pH 6.4); clear wavy boundary.

IIC2—14 to 60 inches; yellowish brown (10YR 5/4) extremely stony sand, light yellowish brown (10YR 6/4) dry; single grain; loose, nonsticky and nonplastic; 30 percent gravel, 20 percent cobbles, 20 percent stones; slightly acid (pH 6.2).

Range in characteristics

Profile: Depth to bedrock—60 inches or more

Mollic epipedon: Thickness—8 to 9 inches

A1 horizon: Hue—10YR or 7.5YR, value - 4 or 5 (dry) and 2 or 3 (moist), chroma - 2 or 3; texture—fine sandy loam, gravelly sandy loam, very cobbly loam; reaction—pH 6.1 to 6.5

C1 horizon: Texture—gravelly coarse sandy loam, very cobbly sandy loam; reaction—pH 6.1 to 6.5

IIC horizon: Depth from surface—14 to 22 inches; texture—very gravelly loamy coarse sand, extremely stony sand; reaction—pH 6.1 to 6.5

Tolman Series

The Tolman series consists of shallow, well drained soils that formed in residuum derived from calcareous sandstone and limestone. These soils are on mountainsides. The natural vegetation is mainly bluebunch wheatgrass (*Agropyron spicatum*) and prairie junegrass (*Koeleria cristata*). Slope is 5 to 35 percent.

Taxonomic class: Loamy-skeletal, mixed Lithic Argiborolls

Typical pedon: Tolman channery loam in an area of Tolman-Beenom Variant-Carbol Variant association, 5 to 35 percent slopes; sec. 14, T. 58 N., R. 90 W.

A1—0 to 4 inches; very dark brown (10YR 2/2) channery loam, dark grayish brown (10YR 4/2) dry; moderate very fine granular structure; very friable, slightly sticky and slightly plastic; 30 percent channery fragments; neutral (pH 6.8); clear smooth boundary.

B21t—4 to 9 inches; very dark grayish brown (10YR 3/2) very channery clay loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky

structure; friable, sticky and plastic; common thin clay films on faces of peds; 40 percent channery fragments; neutral (pH 6.7); clear wavy boundary.

B22t—9 to 15 inches; dark brown (10YR 3/3) very channery clay loam, brown (10YR 4/3) dry; strong medium and fine subangular blocky structure; friable, slightly sticky and slightly plastic; common thin clay films on faces of peds; 50 percent channery fragments; slightly effervescent; mildly alkaline (pH 7.5); abrupt irregular boundary.

R—15 inches; hard calcareous sandstone and cherty limestone.

Range in characteristics

Mollic epipedon: Thickness—6 to 15 inches

Solum: Thickness—13 to 19 inches

A1 horizon: Rock fragment content—15 to 30 percent; color—value - 3 to 5 (dry) and 2 or 3 (moist), chroma - 2 or 3; reaction—pH 6.6 to 7.8

B2t horizon: Rock fragment content—40 to 50 percent; color—value - 4 or 5 (dry) and 3 or 4 (moist), chroma - 2 to 4; texture—loam, clay loam; reaction—pH 6.6 to 7.8

Tongue River Series

The Tongue River series consists of moderately deep, well drained soils that formed in residuum derived from interbedded shale and sandstone. These soils are on mountainsides. The natural vegetation is mainly lodgepole pine (*Pinus contorta*) and grouse whortleberry (*Vaccinium scoparium*). Slope is 2 to 35 percent.

Taxonomic class: Fine-loamy, mixed Typic Cryoboralfs

Typical pedon: Tongue River loam in an area of Tongue River-Gateway association, 2 to 35 percent slopes; sec. 6, T. 54 N., R. 88 W.

O1—1 inch to 0; partly decomposed twigs and needles.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine platy structure parting to strong fine granular; very friable, slightly sticky and slightly plastic; 5 percent gravel; medium acid (pH 6.0); clear wavy boundary.

A2—3 to 7 inches; dark brown (7.5YR 4/4) light sandy clay loam, light brown (7.5YR 6/4) dry; strong medium platy structure; friable, slightly sticky and slightly plastic; 5 percent gravel; medium acid (pH 6.0); gradual irregular boundary.

B&A—7 to 15 inches; brown (10YR 4/3) sandy clay loam, pale brown (10YR 6/3) dry; moderate medium angular blocky structure and moderate medium and coarse platy; friable, sticky and plastic; common moderately thick clay bridges; slightly acid (pH 6.2); gradual irregular boundary.

B2t—15 to 22 inches; dark yellowish brown (10YR 4/4) sandy clay loam, light yellowish brown (10YR 6/4) dry; weak coarse platy structure and moderate medium angular blocky; firm, sticky and plastic; many moderately thick clay films on faces of peds; 10 percent gravel; slightly acid (pH 6.2); gradual wavy boundary.

B3—22 to 29 inches; dark yellowish brown (10YR 4/6) sandy loam, brown (7.5YR 5/4) dry; weak coarse angular blocky structure; friable, slightly sticky and slightly plastic; few thin clay films on faces of peds; 10 percent gravel; slightly acid (pH 6.2); gradual wavy boundary.

C1—29 to 32 inches; brown (10YR 4/4) sandy loam, brown (10YR 5/4) dry; massive; nonsticky and nonplastic; 20 percent gravel; slightly acid (pH 6.2); gradual wavy boundary.

C2r—32 inches; soft interbedded sandstone and shale.

Range in characteristics

Solum: thickness—20 to 32 inches

Profile: Rock fragment content—0 to 25 percent throughout

A2 horizon: Color—hue - 10YR or 7.5YR, value - 5 to 7 (dry) and 3 to 5 (moist), chroma - 2 to 6; texture—loam, silt loam, sandy clay loam; reaction—pH 5.6 to 6.5

B2t horizon: Color—hue - 10YR to 5Y, value - 5 to 7 (dry) and 3 to 5 (moist), chroma - 2 to 4; texture—sandy clay loam, clay loam, silty clay loam; reaction—pH 5.6 to 7.3

C horizon: Hue—10YR or 2.5Y; texture—sandy clay loam, silty clay loam, silt loam; reaction—pH 6.1 to 7.3

Troutville Series

The Troutville series consists of deep, well drained soils that formed in glacial till derived from granite. These soils are on moraines. The natural vegetation is mainly lodgepole pine (*Pinus contorta*) and grouse whortleberry (*Vaccinium scoparium*). Slope is 2 to 40 percent.

Taxonomic class: Loamy-skeletal, mixed Psammentic Cryoboralfs

Typical pedon: Troutville very stony sandy loam in an area of Frisco-Troutville association, 2 to 40 percent slopes; NW1/4 of sec. 35, T. 54 N., R. 87 W.

O1—2 inches to 1 inch; leaf litter and twigs.

O2—1 inch to 0; mostly decomposed leaf litter.

A2—0 to 5 inches; brown (10YR 4/3) very stony sandy loam, pale brown (10YR 6/3) dry; weak fine granular and platy structure; friable, nonsticky and slightly plastic; 20 percent gravel, 5 percent cobbles, 20 percent stones; medium acid (pH 5.6); gradual wavy boundary.

A&B—5 to 12 inches; brown (10YR 5/3) very stony sandy loam, pale brown (10YR 6/3) dry; weak fine granular and angular blocky structure; friable, nonsticky and slightly plastic; few thin clay films on faces of peds of B material; 30 percent gravel, 5

percent cobbles, 20 percent stones; medium acid (pH 5.8); gradual wavy boundary.

B2t—12 to 45 inches; variable colors including brown (10YR 5/3) and dark yellowish brown (10YR 4/4) extremely stony sandy loam containing sandy clay loam lamellae, yellowish brown (10YR 5/4) and pale brown (10YR 6/3) dry; strong medium and coarse angular blocky structure; firm, sticky and plastic; many thin and moderately thick clay films on faces of peds of lamellae; 35 percent gravel, 10 percent cobbles, 20 percent stones; medium acid (pH 5.8).

Range in characteristics

Profile: Depth to bedrock—60 inches or more; rock fragment content—35 to 65 percent gravel, cobbles, and stones in major part of solum

A2 horizon: Color—hue - 10YR or 7.5YR, value - 4 to 6 (dry) and 3 or 4 (moist), chroma - 1 to 4; texture—sandy loam, fine sandy loam, loam; reaction—pH 5.6 to 6.0

B2t horizon: Color—hue - 10YR or 7.5YR, value - 5 to 7 (dry) and 4 or 5 (moist), chroma - 3 or 4; texture—sandy clay loam, sandy loam; reaction—pH 5.6 to 6.0

Waybe Series

The Waybe series consists of shallow, well drained soils that formed in colluvium derived from interbedded shale and limestone. These soils are on landslide deposits. The natural vegetation is mainly big sagebrush (*Artemisia tridentata*) and Idaho fescue (*Festuca idahoensis*). Slope is 5 to 35 percent.

Taxonomic class: Clayey, mixed (calcareous), shallow Typic Cryorthents

Typical pedon: Waybe channery clay in an area of Owen Creek-Waybe association, 5 to 35 percent slopes; SE1/4 of sec. 26, T. 54 N., R. 89 W.

A1—0 to 3 inches; olive gray (5Y 4/2) channery clay, olive gray (10YR 5/2) dry; moderate medium and fine granular structure; firm, sticky and plastic; 20 percent channery fragments; slightly effervescent; mildly alkaline (pH 7.8); gradual irregular boundary.

C1—3 to 16 inches; olive gray (5Y 4/2) clay, olive gray (5Y 5/2) dry; some very dark gray (5Y 3/1) mottles; massive; firm, sticky and plastic; 10 percent channery fragments; slightly effervescent; mildly alkaline (pH 7.8); gradual wavy boundary.

C2r8—16 inches; gray (5Y 5/1) channery shale, light gray (5Y 6/1) dry; 20 percent channery fragments; strongly effervescent; mildly alkaline (pH 7.8).

Range in characteristics

Profile: Rock fragment content—10 to 35 percent throughout

A1 horizon: Color—hue - 10YR to 5Y, value - 5 or 6 (dry) and 4 or 5 (moist), chroma - 1 or 2; texture—clay, clay loam; reaction—pH 7.4 to 8.4

C horizon: Color—hue - 2.5Y or 5Y, value - 5 to 7 (dry) and 4 or 5 (moist), chroma - 1 to 3; texture—clay, clay loam; reaction—pH 7.4 to 8.4

References

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Boul, S. D., F. D. Hole, and F. J. McCracken. 1973. Soil genesis and classification. Iowa State Univ. Press, Ames, Iowa. 360 pp.

(4) Darton, N. H. 1906. Geology of the Bighorn Mountains. U.S. Geol. Surv. Prof. Pap. No. 51. Government Printing Office, Washington, D.C. 129 pp., illus.

(5) Despain, Don G. 1973. Vegetation of the Bighorn Mountains, Wyoming, in relation to substrate and climate. Ecol. Mono. 43, pp. 329-335.

(6) Hoffman, George R. and Robert R. Alexander. 1976. Forest vegetation of the Bighorn Mountains, Wyoming: a habitat type classification. U.S. Dep. Agric., Forest Serv. Res. Pap. RM-170, 38 pp.

(7) Killsgaard, T. H., et. al. 1972. Mineral resources of the Cloud Peak primitive area, Wyoming. U.S. Geol. Serv. Bull. 1371-C.

(8) Love, J. D., et. al. 1978. Preliminary geologic map of the Sheridan quadrangle, northern Wyoming. U.S. Geol. Surv. open-file report 78-456, 5 pp., maps.

(9) Portland Cement Association. 1962. PCA soil primer. 52 pp., illus.

(10) Pritchett, W. L. 1979. Properties and management of forest soils. John Wiley and Sons, New York, 500 pp.

(11) Segerstrom, K., et. al. 1976. Mineral resources of areas adjacent to the Cloud Peak primitive area, Wyoming. U.S. Geol. Surv. Bull. 1991-D.

(12) Trlica, M. J., et. al. [n.d.] An evaluation of the Wyoming bunchgrass scorecard as applied to range lands in the Bighorn National Forest. Unpublished report. Bighorn National Forest Library. 81 pp.

(13) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173–188 issued May 1962]

(14) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Anticline. A unit of folded strata that is convex upward. In a single anticline, beds forming the opposing limbs of the fold dip away from its axial plane.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Back slope. The geomorphic component that forms the steepest inclined surface and principal element of many hillsides. Back slopes in profile are commonly steep, are linear, and may or may not include cliff segments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Cirque. Semicircular, concave, bowllike areas that have steep faces primarily resulting from glacial ice and snow abrasion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter, in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. Mineral or rock particles larger than 2 millimeters in diameter.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—Readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Dip slope. A slope of the land surface, roughly determined by and approximately conforming with the dip of underlying bedded rock.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—These soils have very high and high hydraulic conductivity and low water holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained.—These soils have high hydraulic conductivity and low water holding capacity. Without irrigation, only a narrow range of crops can be grown and yields are low.

Well drained.—These soils have intermediate water holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of some field crops are adversely affected unless artificial drainage is provided. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted unless artificial drainage is provided. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.—These soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.—These soils are wet to the surface most of the time. They are wet enough to prevent the growth of important crops (except rice) unless artificially drained.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and produced by erosion or faulting. Synonym: scarp.

Felsenmeer. An assemblage of rock pieces above timberline.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forage. All browse and nonwoody plants that are available to livestock or game animals and are used for grazing.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual.* The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ

from that in the solum, the number 2 precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Mass wasting (mass movement). Dislodgement and downslope transport of soil material as a unit under direct gravitational stress. The process includes slope displacements such as creep and solifluction, rapid movements such as landslides, and earthflows. Agents of fluid transport (water, ice) may play a subordinate role in the process.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Periglacial. Pertaining to processes, conditions, areas, climates, and topographic features occurring at the immediate margins of former and existing glaciers and ice sheets and influenced by cold temperature of the ice.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Plant association. The climax plant community type.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4

Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil depth. The depth of the soil profile. The depth classes used in this survey area are:

Shallow	Less than 20 inches
Moderately deep	20 to 40 inches
Deep	more than 40 inches

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 6 to 15 inches (15 to 38 centimeters) in length if flat.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Talus. Rock fragments of any size or shape, commonly coarse and angular, derived from and lying at the base of a cliff or very steep, rock slope. The accumulated mass of such loose, broken rock formed chiefly by falling, rolling, or sliding.

Tarn. A small mountain lake or pool, especially one that occupies an ice-gouged basin on the floor of a cirque.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1969-78 at Burgess Junction, WY]

Month	Average temperature	Average precipitation
	°F	In
January	14.4	1.77
February	17.8	1.31
March	19.5	2.34
April	27.3	3.45
May	38.2	2.40
June	48.2	2.20
July	53.8	1.23
August	55.3	1.27
September	43.5	1.54
October	33.7	1.93
November	22.5	1.72
December	16.3	1.42

TABLE 2.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Big Horn	Johnson	Sheridan	Washakie	Total-- Area	Total-- Extent
		Acres	Acres	Acres	Acres	Acres	Pct
10	Agneston-Granile-Rock outcrop association, 5 to 50 percent slopes	23,072	64,540	49,614	7,271	144,497	13.0
11	Agneston-Leighcan association, 5 to 30 percent slopes	3,041	34,590	19,308	0	56,939	5.1
12	Chilton Variant-Sunup-Spearfish Variant association, 5 to 60 percent slopes	1,122	0	0	0	1,122	0.1
13	Cirque land, 10 to 130 percent slopes	10,145	16,608	0	0	26,753	2.4
14	Cloud Peak gravelly silt loam, 5 to 45 percent slopes	37,551	268	65,570	3,882	107,271	9.6
15	Cloud Peak-Eutroboralfs-Argiborolls association, 10 to 65 percent slopes	0	1,277	25,754	0	27,031	2.4
16	Cryaquolls, 0 to 5 percent slopes	5,034	3,973	5,162	159	14,328	1.3
17	Farlow-Pishkun association, 5 to 40 percent slopes	5,333	0	3,510	557	9,400	0.8
18	Fourmile loam, 2 to 30 percent slopes	1,711	12,744	1,415	222	16,092	1.4
19	Frisco-Troutville association, 2 to 40 percent slopes	24,944	32,517	10,061	938	68,460	6.1
20	Grobutte very gravelly loam, 8 to 60 percent slopes	3,443	0	0	0	3,443	0.3
21	Hanson-Raynesford association, 0 to 30 percent slopes	898	0	867	0	1,765	0.2
22	Hanson Variant-Starley association, 10 to 60 percent slopes	491	0	8,516	2,657	11,664	1.0
23	Inchau-Carbol association, 2 to 20 percent slopes	1,166	0	846	0	2,012	0.2
24	Leavitt-Passcreek association, 2 to 30 percent slopes	2,064	516	1,868	270	4,718	0.4
25	Lucky-Burgess-Hazton association, 2 to 30 percent slopes	13,086	3,394	11,735	222	28,437	2.6
26	Mirror-Teewinot-Bross association, 2 to 40 percent slopes	7,537	3,604	1,563	0	12,704	1.1
27	Nathrop-Passcreek-Starley association, 2 to 30 percent slopes	27,852	121	26,121	5,343	59,437	5.3
28	Nathrop Variant-Nielsen-Passcreek association, 2 to 35 percent slopes	0	0	1,557	0	1,557	0.1
29	Owen Creek-Echemoor-Bynum association, 2 to 30 percent slopes	14,541	1,152	25,544	3,569	44,806	4.0
30	Owen Creek-Waybe association, 5 to 35 percent slopes	13,500	0	11,588	1,142	26,230	2.4
31	Rock outcrop-Agneston-Rubble land association, 5 to 60 percent slopes	8,164	21,859	11,137	0	41,160	3.7
32	Rock outcrop-Cloud Peak association, 10 to 70 percent slopes	14,580	1,071	19,200	2,500	37,351	3.4
33	Rock outcrop-Mirror-Teewinot association, 5 to 35 percent slopes	15,972	24,640	7,823	0	48,435	4.3
34	Rock outcrop-Starman association, 5 to 70 percent slopes	2,227	382	310	1,482	4,401	0.4
35	Rock outcrop-Starman Variant association, 10 to 70 percent slopes	5,271	0	1,292	0	6,563	0.6
36	Rock outcrop-Teewinot-Agneston association, 5 to 35 percent slopes	43,711	29,050	3,352	0	76,113	6.8
37	Rubble land, 5 to 50 percent slopes	20,363	19,221	0	0	39,584	3.6
38	Sapphire-Bottle-Foxton association, 2 to 35 percent slopes	2,159	82	8,301	0	10,542	1.0
39	Starman-Starley association, 2 to 30 percent slopes	17,295	0	13,304	1,722	32,321	2.9
40	Tellman-Granile-Agneston association, 2 to 20 percent slopes	6,918	54,705	33,834	0	95,457	8.6
41	Tine-Fourmile association, 2 to 30 percent slopes	4,276	421	203	667	5,567	0.5
42	Tolman-Beenom Variant-Carbol Variant association, 5 to 35 percent slopes	0	227	3,839	0	4,066	0.4
43	Tongue River-Gateway association, 2 to 35 percent slopes	11,161	0	25,035	4,032	40,228	3.6
	Water	1,855	1,644	992	128	4,619	0.4
	Total	350,483	328,606	399,221	36,763	1,115,073	100.0

TABLE 3.--USE AND MANAGEMENT OF THE SOILS

[Absence of an entry indicates that the soil does not support commercial trees]

Soil name and map symbol	Limitations for--- Revegetation	Reforestation	Unsurfaced roads
10:			
Agneston	Severe: too acid.	Moderate: rooting depth.	Moderate: depth to rock.
Granile	Moderate: small stones.	Moderate: small stones.	Slight.
Rock outcrop.			
11:			
Agneston	Severe: too acid.	Moderate: rooting depth.	Moderate: depth to rock.
Leighcan	Severe: too acid.	Moderate: small stones.	Moderate: erodes easily.
12:			
Chilton Variant	Severe: small stones.	---	Slight.
Sunup	Severe: rooting depth, large stones.	---	Severe: depth to rock, large stones.
Spearfish Variant	Severe: rooting depth.	---	Moderate: erodes easily.
13. Cirque land			
14 Cloud Peak	Moderate: small stones.	Moderate: small stones.	Moderate: depth to rock.
15:			
Cloud Peak	Moderate: small stones.	Moderate: small stones.	Moderate: depth to rock.
Eutroboralfs	Moderate: small stones.	Moderate: small stones.	Moderate: depth to rock.
Argiborolls	Moderate to severe: rooting depth.	---	Moderate to severe: depth to rock.
16 Cryaquolls	Severe: wetness.	---	Severe: wetness.
17:			
Farlow	Moderate: small stones.	---	Severe: slippage.
Pishkin	Severe: small stones.	---	Severe: slippage.
18 Fourmile	Moderate: rooting depth.	---	Moderate: large stones.
19:			
Frisco	Moderate: small stones.	Moderate: small stones	Severe: large stones.
Troutville	Severe: large stones.	Severe: large stones.	Severe: large stones.

TABLE 3.--USE AND MANAGEMENT OF THE SOILS--Continued

Soil name and map symbol	Limitations for--- Revegetation	Reforestation	Unsurfaced roads
20 Grobutte	Moderate: small stones.	---	Slight.
21:			
Hanson	Severe: small stones.	---	Slight.
Raynesford	Slight	---	Moderate: erodes easily.
22:			
Hanson Variant	Moderate: small stones.	---	Moderate: depth to rock.
Starley	Severe: rooting depth.	---	Severe: depth to rock.
23:			
Inchau	Moderate: rooting depth.	---	Moderate: erodes easily.
Carbol	Severe: rooting depth.	---	Severe: depth to rock.
24:			
Leavitt	Slight	---	Severe: erodes easily.
Passcreek	Moderate: rooting depth.	---	Moderate: depth to rock.
25:			
Lucky	Moderate: rooting depth.	---	Moderate: depth to rock.
Burgess	Moderate: rooting depth.	---	Moderate: depth to rock.
Haxton	Severe: rooting depth.	---	Severe: depth to rock.
26:			
Mirror	Severe: too acid, too cold.	---	Moderate: depth to rock.
Teewinot	Severe: rooting depth, small stones.	---	Severe: depth to rock.
Bross	Severe: too acid, too cold.	---	Moderate: large stones.
27:			
Nathrop	Moderate: rooting depth.	---	Moderate: depth to rock.
Passcreek	Moderate: rooting depth.	---	Moderate: depth to rock.
Starley	Severe: rooting depth.	---	Severe: depth to rock.

TABLE 3.--USE AND MANAGEMENT OF THE SOILS--Continued

Soil name and map symbol	Limitations for--- Revegetation	Reforestation	Unsurfaced roads
28:			
Nathrop Variant----	Moderate: rooting depth.	---	Moderate: depth to rock.
Nielsen------------	Severe: rooting depth.	---	Severe: depth to rock.
Passcreek----------	Moderate: rooting depth.	---	Moderate: depth to rock.
29:			
Owen Creek---------	Moderate: too clayey.	---	Severe: slippage, too clayey.
Echemoor-----------	Moderate: rooting depth.	---	Severe: slippage, erodes too easily.
Bynum--------------	Moderate: rooting depth.	---	Severe: slippage.
30:			
Owen Creek---------	Moderate: too clayey.	---	Severe: slippage, too clayey.
Waybe--------------	Severe: rooting depth, too clayey.	---	Severe: slippage, too clayey.
31: Rock outcrop.			
Agneston-----------	Severe: too acid.	Moderate: rooting depth.	Moderate: depth to rock.
Rubble land.			
32: Rock outcrop.			
Cloud Peak---------	Moderate: small stones.	Moderate: small stones.	Moderate: depth to rock.
33: Rock outcrop.			
Mirror-------------	Severe: too acid, too cold.	---	Moderate: depth to rock.
Teewinot-----------	Severe: rooting depth, small stones.	---	Severe: depth to rock.
34: Rock outcrop.			
Starman------------	Severe: rooting depth, small stones.	---	Severe: depth to rock.
35: Rock outcrop.			
Starman Variant----	Severe: rooting depth, small stones.	---	Severe: depth to rock.

TABLE 3.--USE AND MANAGEMENT OF THE SOILS--Continued

Soil name and map symbol	Limitations for--- Revegetation	Reforestation	Unsurfaced roads
36: Rock outcrop.			
Teewinot	Severe: rooting depth, small stones.	---	Severe: depth to rock.
Agneston	Severe: too acid.	Moderate: rooting depth.	Moderate: depth to rock.
37. Rubble land			
38: Sapphire	Moderate: rooting depth.	Moderate: rooting depth.	Moderate: depth to rock.
Bottle	Severe: too acid, droughty.	Severe: droughty.	Moderate: depth to rock.
Foxton	Moderate: thin layer.	Severe: too clayey.	Severe: too clayey.
39: Starman	Severe: rooting depth, small stones.	---	Severe: depth to rock.
Starley	Severe: rooting depth.	---	Severe: depth to rock.
40: Tellman	Severe: too acid.	Moderate: small stones.	Slight.
Granile	Moderate: small stones.	Moderate: small stones.	Slight.
Agneston	Severe: too acid.	Moderate: rooting depth.	Moderate: depth to rock.
41: Tine	Moderate: small stones.	---	Severe: large stones.
Fourmile	Moderate: rooting depth.	---	Moderate: large stones.
42: Tolman	Severe: rooting depth.	---	Severe: depth to rock.
Beenon Variant	Moderate: rooting depth.	---	Moderate: erodes easily.
Carbol Variant	Severe: rooting depth.	---	Severe: depth to rock.
43: Tongue River	Moderate: rooting depth.	Moderate: rooting depth.	Severe: slippage.
Gateway	Severe: too clayey.	Severe: too clayey.	Severe: slippage, too clayey.

TABLE 4.--PLANT ASSOCIATIONS AND POTENTIAL PRODUCTION

[Absence of an entry indicates that the soil does not support significant amounts of the stated vegetation]

Soil name and map symbol	Plant association	Potential annual timber production	Potential annual forage production
		Ft³/acre	Lb/acre
10:			
Agneston	Lodgepole pine/grouse whortleberry	27	500-700
Granile	Lodgepole pine/grouse whortleberry	29	500-700
Rock outcrop*.			
11:			
Agneston	Engelmann spruce/grouse whortleberry	36	500-700
Leighcan	Engelmann spruce/grouse whortleberry	42	500-700
12:			
Chilton Variant	Utah juniper/big sagebrush	---	600-800
Sunup	Utah juniper/big sagebrush	---	600-800
Spearfish Variant	Utah juniper/big sagebrush	---	600-800
13*. Cirque land			
14:			
Cloud Peak	Douglas-fir/mountain ninebark	36	500-700
Cloud Peak	Engelmann spruce/grouse whortleberry	60	500-700
15:			
Cloud Peak	Douglas-fir/mountain ninebark	37	500-700
Eutroboralfs	Douglas-fir/mountain ninebark	37	500-700
Argiborolls	Bluebunch wheatgrass	---	1,500-1,800
16:			
Cryaquolls	Tufted hairgrass/alpine timothy	---	3,000-3,500
17:			
Farlow	Big sagebrush/Idaho fescue	---	1,500-1,800
Pishkin	Big sagebrush/Idaho fescue	---	1,200-1,700
18 Fourmile	Idaho fescue/silky lupine	---	1,500-1,800
19:			
Frisco	Lodgepole pine/grouse whortleberry	41	500-700
Troutville	Lodgepole pine/grouse whortleberry	28	500-700
20 Grobutte	Black sagebrush/bluebunch wheatgrass	---	600-800
21:			
Hanson	Idaho fescue/silky lupine	---	1,500-1,800
Raynesford	Idaho fescue/silky lupine	---	1,500-1,800

See footnotes at end of table.

TABLE 4.--PLANT ASSOCIATIONS AND POTENTIAL PRODUCTION--Continued

Soil name and map symbol	Plant association	Potential annual timber production	Potential annual forage production
		Ft^3/acre	Lb/acre
22:			
Hanson Variant	Idaho fescue/bluebunch wheatgrass	---	1,200-1,700
Starley	Idaho fescue/sedge	---	1,200-1,700
23:			
Inchau	Idaho fescue/sedge	---	1,500-1,800
Carbol	Idaho fescue/sedge	---	600-800
24:			
Leavitt	Idaho fescue/silky lupine	---	1,600-2,400
Passcreek	Idaho fescue/silky lupine	---	1,600-2,400
25:			
Lucky	Idaho fescue/sedge	---	1,500-1,800
Burgess	Idaho fescue/sedge	---	1,500-1,800
Hazton	Idaho fescue/sedge	---	600-800
26:			
Mirror	Alpine**	---	600-800
Teewinot	Alpine**	---	600-800
Bross	Alpine**	---	1,200-1,700
27:			
Nathrop	Idaho fescue/silky lupine	---	1,600-2,400
Passcreek	Idaho fescue/silky lupine	---	1,600-2,400
Starley	Idaho fescue/sedge	---	1,200-1,700
28:			
Nathrop Variant	Idaho fescue/silky lupine	---	1,200-1,700
Nielsen	Idaho fescue/silky lupine	---	1,200-1,700
Passcreek	Idaho fescue/silky lupine	---	1,600-2,400
29:			
Owen Creek	Big sagebrush/Idaho fescue	---	1,600-2,400
Echemoor	Big sagebrush/Idaho fescue	---	3,000-3,500
Bynum	Big sagebrush/Idaho fescue	---	1,600-2,400
30:			
Owen Creek	Big sagebrush/Idaho fescue	---	1,600-2,400
Waybe	Big sagebrush/Idaho fescue	---	600-800
31:			
Rock outcrop*.			
Agneston	Lodgepole pine/grouse whortleberry	27	500-700
Rubble land*.			
32:			
Rock outcrop*.			
Cloud Peak	Douglas-fir/mountain ninebark	37	500-700

See footnotes at end table.

TABLE 4.--PLANT ASSOCIATIONS AND POTENTIAL PRODUCTION--Continued

Soil name and map symbol	Plant association	Potential annual timber production	Potential annual forage production
		Ft^3/acre	Lb/acre
33:			
Rock outcrop*.			
Mirror	Alpine**	---	600-800
Teewinot	Alpine**	---	600-800
34:			
Rock outcrop*.			
Starman	Idaho fescue/sedge	---	600-800
35:			
Rock outcrop*.			
Starman Variant	Mountainmahogany/bluebunch wheatgrass	---	600-800
36:			
Rock outcrop*.			
Teewinot	Alpine**	---	600-800
Agneston	Engelmann spruce/grouse whortleberry	36	500-700
37*.			
Rubble land			
38:			
Sapphire	Lodgepole pine/grouse whortleberry	53	500-700
Bottle	Lodgepole pine/grouse whortleberry	32	500-700
Foxton	Lodgepole pine/grouse whortleberry	35	500-700
39:			
Starman	Idaho fescue/sedge	---	600-800
Starley	Idaho fescue/sedge	---	1,200-1,700
40:			
Tellman	Lodgepole pine/grouse whortleberry	20	500-700
Granile	Lodgepole pine/grouse whortleberry	29	500-700
Agneston	Lodgepole pine/grouse whortleberry	27	500-700
41:			
Tine	Big sagebrush/Idaho fescue	---	1,500-1,800
Fourmile	Idaho fescue/silky lupine	---	1,500-1,800
42:			
Tolman	Bluebunch wheatgrass/prairie junegrass	---	1,500-1,800
Beenom Variant	Bluebunch wheatgrass/prairie junegrass	---	1,600-2,400
Carbol Variant	Bluebunch wheatgrass/prairie junegrass	---	1,500-2,800
43:			
Tongue River	Lodgepole pine/grouse whortleberry	29	500-700
Gateway	Engelmann spruce/grouse whortleberry	71	500-700

*Supports little if any vegetation.
**Alpine vegetation includes several plant associations. Because of the lower intensity of mapping on these soils, no attempt was made to correlate specific soils with specific plant associations.

TABLE 5.--ENGINEERING INDEX PROPERTIES

[The symbol > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
10*:											
Agneston--------	0-2	Sandy loam-------	SM-SC	A-2, A-4	0	90-100	85-95	35-45	25-40	20-30	5-10
	2-7	Gravelly coarse sandy loam.	SM	A-1, A-2	5-10	70-95	60-85	25-35	15-35	---	NP
	7-22	Very cobbly sandy clay loam.	GC	A-6, A-2	35-45	65-85	55-75	40-60	25-50	30-35	10-15
	22-28	Very cobbly fine sandy loam.	GM-GC	A-2	35-45	65-85	55-75	50-60	25-35	20-30	5-10
	28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Granile---------	0-2	Gravelly sandy loam.	SM-SC	A-2	0	80-85	70-75	50-55	25-30	25-30	5-10
	2-8	Very gravelly coarse sandy loam.	GM	A-1	10-20	60-65	55-60	35-40	20-25	---	NP
	8-12	Very gravelly sandy clay loam.	GC	A-2	10-20	65-75	40-50	35-45	30-35	35-40	15-20
	12-20	Very cobbly sandy clay loam.	GC	A-2	25-35	60-65	55-60	45-55	30-35	35-40	15-20
	20-45	Very cobbly sandy loam.	GM	A-1, A-2	40-50	75-80	70-75	40-50	20-30	---	NP
	45	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
11*:											
Agneston--------	0-2	Sandy loam-------	SM-SC	A-2, A-4	0	90-100	85-95	35-45	25-40	20-30	5-10
	2-7	Gravelly coarse sandy loam.	SM	A-1, A-2	5-10	70-95	60-85	25-35	15-35	---	NP
	7-22	Very cobbly sandy clay loam.	GC	A-6, A-2	35-45	65-85	55-75	40-60	25-50	30-35	10-15
	22-28	Very cobbly fine sandy loam.	GM-GC	A-2	35-45	65-85	55-75	50-60	25-35	20-30	5-10
	28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Leighcan--------	0-6	Gravelly loam----	CL-ML, GM-GC, SM-SC	A-4	0	65-85	60-75	55-65	40-60	20-30	5-10
	6-20	Cobbly coarse sandy loam.	SM	A-2	20-30	75-85	70-80	50-60	25-35	---	NP
	20-30	Very cobbly sandy loam.	GM	A-2	30-40	70-80	65-75	45-55	25-35	---	NP
	30-42	Very cobbly sand	SP-SM	A-1, A-3	40-50	75-90	70-85	40-60	5-10	---	NP
	42	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
12*:											
Chilton Variant	0-3	Very channery loam.	GM	A-2	10-20	45-55	45-55	40-45	25-35	20-25	NP-5
	3-12	Very channery loam.	GM	A-2	10-20	45-55	45-55	35-45	30-35	20-25	NP-5
	12-42	Extremely channery loam.	GM	A-1	10-20	25-30	25-30	20-30	10-15	20-25	NP-5
Sunup-----------	0-4	Very stony fine sandy loam.	SM	A-2	45-55	75-85	70-80	50-65	25-35	---	NP
	4-10	Very stony fine sandy loam.	SM	A-2	45-55	75-85	70-80	50-65	25-35	---	NP
	10	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 5.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
12*: Spearfish Variant--------	0-4	Gravelly loam----	SM-SC, GM-GC	A-4	0	70-80	60-70	55-65	40-50	25-30	5-10
	4-14	Loam-------------	CL-ML	A-4	0	100	100	85-95	60-75	25-30	5-10
	14	Weathered bedrock	---	---	---	---	---	---	---	---	---
13*. Cirque land											
14--------------- Cloud Peak	0-2	Gravelly silt loam.	ML	A-4	0	70-75	70-75	70-75	60-70	35-40	5-10
	2-22	Very gravelly silty clay loam.	GC	A-2, A-6	0-20	25-50	25-50	25-50	20-45	35-40	15-20
	22-38	Very cobbly silt loam.	ML, GM	A-4	45-55	70-85	70-85	65-75	60-70	35-40	5-10
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
15*: Cloud Peak------	0-2	Gravelly silt loam.	ML	A-4	0	70-75	70-75	70-75	60-70	35-40	5-10
	2-22	Very gravelly silty clay loam.	GC	A-2, A-6	0-20	25-50	25-50	25-50	20-45	35-40	15-20
	22-38	Very cobbly silt loam.	ML, GM	A-4	45-55	70-85	70-85	65-75	60-70	35-40	5-10
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Eutroboralfs.											
Argiborolls.											
16*. Cryaquolls											
17*: Farlow----------	0-8	Gravelly loam----	ML, GM, SM	A-4	5-10	70-80	65-75	60-70	40-55	15-25	NP-5
	8-16	Gravelly clay loam, channery clay loam.	GM-GC	A-4	0	55-65	50-60	45-55	35-45	25-30	5-10
	16-45	Very channery loam, very gravelly clay loam, extremely gravelly loam.	GM, GP-GM	A-1	5-10	0-40	0-40	5-35	5-30	15-25	NP-5
Pishkun---------	0-7	Very gravelly loam.	GM, GM-GC	A-4, A-2	5-25	40-60	35-55	30-50	25-40	20-30	NP-10
	7-42	Extremely gravelly loam, extremely gravelly sandy loam, extremely gravelly clay loam.	GP-GC, GM-GC, GC	A-2	25-40	25-40	10-35	5-30	5-25	25-35	5-15
18--------------- Fourmile	0-6	Loam-------------	CL-ML	A-4	0	80-100	70-90	65-75	50-60	25-30	5-10
	6-24	Very cobbly sandy clay loam.	SC, GC	A-6	35-40	70-80	60-70	50-60	40-50	30-40	10-20
	24-41	Extremely cobbly loamy coarse sand.	GP-GM	A-1	55-65	45-50	30-45	20-30	5-10	---	NP

See footnote at end of table.

TABLE 5.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
27*:											
Nathrop---------	0-8	Loam-------------	CL-ML, ML	A-4	0	100	100	85-95	60-75	25-35	5-10
	8-38	Very stony clay loam, extremely stony clay loam, very cobbly clay loam.	CL	A-6	40-60	70-80	70-80	60-75	50-65	30-40	10-15
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Passcreek-------	0-7	Loam-------------	CL-ML, ML	A-4	0	80-100	75-100	65-85	50-70	25-35	5-10
	7-12	Clay loam, loam	CL	A-6	0	80-100	75-100	65-100	55-75	30-40	10-15
	12-19	Channery loam, gravelly clay loam.	CL-ML, CL	A-4, A-6	10-15	75-90	658	55-70	50-60	25-35	5-15
	19-30	Very gravelly loam.	GM-GC	A-2, A-4	0	55-60	45-50	40-50	30-40	25-30	5-10
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Starley---------	0-8	Loam-------------	CL-ML	A-4	0	100	95-100	85-95	60-75	25-30	5-10
	8-15	Extremely cobbly loam.	GM-GC	A-4	45-60	80-90	70-80	55-70	35-45	25-35	5-10
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
28*:											
Nathrop Variant	0-7	Channery very fine sandy loam.	SM-SC	A-4	0	70-80	70-80	60-75	35-45	15-20	5-10
	7-22	Very channery fine sandy clay loam, very channery clay loam.	GC	A-2	0	40-45	30-40	25-35	20-30	25-30	10-15
	22	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Nielsen---------	0-10	Channery loam----	GC	A-6	0	65-75	60-70	50-65	35-50	30-35	10-15
	10-18	Very channery clay loam.	GC	A-6	0	35-40	30-35	25-30	20-25	35-40	15-20
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Passcreek-------	0-7	Loam-------------	CL-ML, ML	A-4	0	80-100	75-100	65-85	50-70	25-35	5-10
	7-12	Clay loam, loam	CL	A-6	0	80-100	75-100	65-100	55-75	30-40	10-15
	12-19	Channery loam, gravelly clay loam.	CL-ML, CL	A-4, A-6	10-15	75-90	658	55-70	50-60	25-35	5-15
	19-30	Very gravelly loam.	GM-GC	A-2, A-4	0	55-60	45-50	40-50	30-40	25-30	5-10
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
29*:											
Owen Creek------	0-4	Clay loam--------	CL	A-6	0	100	100	90-100	70-80	35-40	15-20
	4-17	Clay-------------	CH	A-7	0	100	100	90-100	75-95	55-65	30-40
	17-24	Channery clay----	GC	A-7	0	65-70	60-65	55-60	45-55	55-65	30-40
	24	Weathered bedrock	---	---	---	---	---	---	---	---	---
Echemoor--------	0-14	Silt loam--------	CL	A-6	0	75-100	75-100	65-90	55-70	30-35	10-15
	14-33	Clay loam, silty clay loam.	CL	A-6	0	75-100	75-100	70-90	65-85	30-40	15-20
	33	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 5.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
24*:											
Leavitt----------	0-3	Loam-------------	ML	A-4	0	75-100	75-100	70-100	60-80	25-35	NP-5
	3-12	Silt loam--------	ML	A-4	0	75-100	75-100	65-90	60-80	25-35	NP-5
	12-25	Clay loam, loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	75-100	75-100	70-10	55-85	25-35	5-15
	25-44	Gravelly silty clay loam.	CL	A-6	0	65-75	60-70	55-65	50-60	35-40	15-20
Passcreek--------	0-7	Loam-------------	CL-ML, ML	A-4	0	80-100	75-100	65-85	50-70	25-35	5-10
	7-12	Clay loam, loam	CL	A-6	0	80-100	75-100	65-100	55-75	30-40	10-15
	12-19	Channery loam, gravelly clay loam.	CL-ML, CL	A-4, A-6	10-15	75-90	658	55-70	50-60	25-35	5-15
	19-30	Very gravelly loam.	GM-GC	A-2, A-4	0	55-60	45-50	40-50	30-40	25-30	5-10
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
25*:											
Lucky------------	0-7	Gravelly loam----	CL-ML	A-4	0	80-85	70-75	65-75	50-60	20-25	5-10
	7-20	Gravelly sandy clay loam, gravelly clay loam.	SC, GC, CL	A-6, A-2	0-10	50-80	50-75	35-70	25-60	25-35	10-15
	20-30	Very gravelly coarse sandy loam.	GM	A-1	0	45-50	40-45	20-30	15-20	---	NP
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Burgess----------	0-3	Loam-------------	ML	A-4	0	100	95-100	85-95	70-75	---	NP
	3-29	Gravelly coarse sandy loam, gravelly sandy loam.	SM, GM	A-1, A-2	0	60-80	50-75	25-45	15-30	---	NP
	29	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Hazton-----------	0-7	Gravelly sandy loam.	SM-SC	A-2	0	80-85	70-75	50-55	25-30	25-30	5-10
	7-13	Gravelly coarse sandy loam.	GM, SM	A-1, A-2	0-5	50-100	50-75	30-60	15-30	20-25	NP-5
	13	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
26*:											
Mirror-----------	0-10	Cobbly loam------	CL-ML, CL	A-4, A-6	20-30	80-85	75-80	65-75	50-60	25-35	5-15
	10-33	Very cobbly loam.	GC	A-6	25-35	65-70	60-65	50-55	35-45	30-35	10-15
	33	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Teewinot---------	0-17	Very cobbly loam	GM	A-1, A-2	30-40	45-60	35-55	30-50	20-35	15-25	NP-5
	17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Bross------------	0-2	Gravelly loam----	CL-ML	A-4	10-15	85-90	70-80	65-75	50-60	15-25	NP-5
	2-27	Very cobbly loam	GC	A-6	30-50	60-85	55-80	50-75	40-50	30-35	10-15
	27-42	Very cobbly sandy loam, very gravelly sandy loam.	SM, GM	A-1	20-60	60-90	40-55	30-50	15-25	---	NP-5

See footnote at end of table.

TABLE 5.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
19*:											
Frisco----------	0-2	Loam------------	ML, SM	A-2, A-4	0-5	80-95	75-90	50-75	30-60	15-20	NP-5
	2-14	Cobbly sandy loam	SM-SC	A-2	10-20	85-90	80-85	45-55	25-30	25-30	5-10
	14-50	Very stony sandy clay loam, very cobbly sandy clay loam, very gravelly loam.	GC, SC	A-2	35-80	50-75	35-60	30-40	20-35	25-35	10-15
	50-60	Extremely stony sandy loam.	GM	A-1	55-65	45-50	40-45	25-30	10-15	---	NP
Troutville------	0-12	Very stony sandy loam.	SM, GM	A-1, A-2	20-60	45-70	40-65	30-60	15-35	---	NP
	12-45	Extremely stony sandy loam, very stony sandy loam, very cobbly sandy loam.	GM, SM	A-1, A-2	60-75	35-65	35-60	25-50	15-30	---	NP
20--------------- Grobutte	0-10	Very gravelly loam.	GM-GC, GC	A-4, A-6	10-20	60-65	55-60	50-55	40-45	25-35	5-15
	10-41	Extremely gravelly loam.	GM-GC, GC	A-2	10-20	35-40	30-35	25-30	20-25	25-35	5-15
21*:											
Hanson----------	0-41	Very cobbly loam	GM, GM-GC, SM-SC, SM	A-2, A-4	40-50	50-75	45-70	40-65	25-50	15-30	NP-10
Raynesford------	0-12	Loam------------	ML, CL-ML	A-4	0-5	85-100	80-100	70-90	50-75	20-30	NP-10
	12-31	Clay loam, loam, gravelly loam.	CL-ML, CL, SM, GM	A-4, A-6	0-15	70-100	60-100	50-90	40-80	20-35	NP-15
	31-41	Very cobbly loam	GM-GC, GM	A-2, A-4	30-40	45-70	40-65	35-60	25-50	20-30	NP-10
22*:											
Hanson Variant--	0-9	Very gravelly silt loam.	GC	A-6, A-2	0	45-55	40-50	35-50	30-45	30-35	10-15
	9-24	Very gravelly loam.	GM-GC	A-2	0	45-50	40-50	35-40	25-30	25-30	5-10
	24	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Starley---------	0-8	Loam------------	CL-ML	A-4	0	100	95-100	85-95	60-75	25-30	5-10
	8-15	Extremely cobbly loam.	GM-GC	A-4	45-60	80-90	70-80	55-70	35-45	25-35	5-10
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
23*:											
Inchau----------	0-7	Loam------------	CL-ML, ML	A-4	0	75-100	75-100	70-90	50-70	25-35	5-10
	7-20	Clay loam--------	CL	A-6, A-7	0	100	95-100	90-100	70-80	35-45	15-25
	20-28	Gravelly loam, gravelly clay loam, clay loam.	GM-GC, GC, CL	A-4, A-6	0-10	55-85	50-85	45-80	35-60	25-35	5-15
	28	Weathered bedrock	CL-ML	---	---	---	---	---	---	---	---
Carbol----------	0-6	Loam------------	ML	A-4	0	90-95	85-90	75-85	60-70	20-25	NP-5
	6-12	Gravelly sandy clay loam.	SM-SC, SC	A-2, A-4, A-6	0-5	80-95	50-75	30-55	20-40	20-30	5-15
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 5.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
29*:											
Bynum	0-7	Silt loam	CL-ML	A-4	0-10	85-100	80-100	70-95	60-85	20-30	5-10
	7-11	Silty clay loam, clay loam, loam.	CL, CL-ML	A-6, A-4	0-10	85-100	80-100	65-90	5-85	20-35	5-15
	11-27	Silty clay loam, loam, channery clay loam.	CL-ML, CL, GM-GC, GC	A-4, A-6	0-10	65-100	60-95	55-85	45-85	20-35	5-15
	27	Weathered bedrock	---	---	---	---	---	---	---	---	---
30*:											
Owen Creek	0-4	Clay loam	CL	A-6	0	100	100	90-100	70-80	35-40	15-20
	4-17	Clay	CH	A-7	0	100	100	90-100	75-95	55-65	30-40
	17-24	Channery clay	GC	A-7	0	65-70	60-65	55-60	45-55	55-65	30-40
	24	Weathered bedrock	---	---	---	---	---	---	---	---	---
Waybe	0-3	Channery clay	CL, CH	A-7	0-5	70-80	65-75	60-70	50-65	40-60	20-35
	3-16	Clay, silty clay loam, channery clay.	CL, CH	A-7, A-6	0-5	70-100	65-100	60-95	50-80	35-60	15-35
	16	Weathered bedrock.	---	---	---	---	---	---	---	---	---
31*: Rock outcrop.											
Agneston	0-2	Sandy loam	SM-SC	A-2, A-4	0	90-100	85-95	35-45	25-40	20-30	5-10
	2-7	Gravelly coarse sandy loam.	SM	A-1, A-2	5-10	70-95	60-85	25-35	15-35	---	NP
	7-22	Very cobbly sandy clay loam.	GC	A-6, A-2	35-45	65-85	55-75	40-60	25-50	30-35	10-15
	22-28	Very cobbly fine sandy loam.	GM-GC	A-2	35-45	65-85	55-75	50-60	25-35	20-30	5-10
	28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rubble land.											
32*: Rock outcrop.											
Cloud Peak	0-2	Gravelly silt loam.	ML	A-4	0	70-75	70-75	70-75	60-70	35-40	5-10
	2-22	Very gravelly silty clay loam.	GC	A-2, A-6	0-20	25-50	25-50	25-50	20-45	35-40	15-20
	22-38	Very cobbly silt loam.	ML, GM	A-4	45-55	70-85	70-85	65-75	60-70	35-40	5-10
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
33*: Rock outcrop.											
Mirror	0-10	Cobbly loam	CL-ML, CL	A-4, A-6	20-30	80-85	75-80	65-75	50-60	25-35	5-15
	10-33	Very cobbly loam.	GC	A-6	25-35	65-70	60-65	50-55	35-45	30-35	10-15
	33	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Teewinot	0-17	Very cobbly loam	GM	A-1, A-2	30-40	45-60	35-55	30-50	20-35	15-25	NP-5
	17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
34*: Rock outcrop.											

See footnote at end of table.

TABLE 5.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
34*:											
Starman	0-3	Channery clay loam.	GC	A-6, A-7	0	60-65	55-60	50-55	40-50	35-45	15-25
	3-15	Extremely channery clay loam.	GC	A-2	0	30-35	20-25	20-25	10-20	35-45	15-25
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
35*: Rock outcrop.											
Starman Variant	0-2	Very channery loam.	GM	A-1	0	35-40	30-40	25-30	20-25	25-30	NP-5
	2-11	Extremely gravelly loam, extremely channery loam.	GC, GM-GC	A-1	0	40-50	20-25	15-25	10-20	25-35	5-15
	11	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
36*: Rock outcrop.											
Teewinot	0-17	Very cobbly loam	GM	A-1, A-2	30-40	45-60	35-55	30-50	20-35	15-25	NP-5
	17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Agneston	0-2	Sandy loam	SM-SC	A-2, A-4	0	90-100	85-95	35-45	25-40	20-30	5-10
	2-7	Gravelly coarse sandy loam.	SM	A-1, A-2	5-10	70-95	60-85	25-35	15-35	---	NP
	7-22	Very cobbly sandy clay loam.	GC	A-6, A-2	35-45	65-85	55-75	40-60	25-50	30-35	10-15
	22-28	Very cobbly fine sandy loam.	GM-GC	A-2	35-45	65-85	55-75	50-60	25-35	20-30	5-10
	28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
37*. Rubble land											
38*:											
Sapphire	0-13	Fine sandy loam	SM, SM-SC	A-2, A-4	0	80-95	75-90	55-75	30-50	20-30	NP-10
	13-23	Sandy clay loam	SC	A-2, A-6	0-5	85-100	80-95	65-85	30-50	30-40	10-15
	23-31	Channery sandy clay loam.	GC, SC	A-2, A-6	0-10	60-80	55-75	45-70	20-40	30-40	10-15
	31	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Bottle	0-8	Sandy loam	SM	A-2, A-4	0	100	90-100	60-70	30-40	20-25	NP-5
	8-15	Loamy fine sand, gravelly loamy fine sand, gravelly fine sandy loam.	SM	A-2	0-15	65-100	55-100	50-85	15-20	---	NP
	15-27	Very gravelly sand.	SP, SP-SM	A-1	0	60-70	40-50	25-35	0-10	---	NP
	27	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Foxton	0-5	Loam	CL	A-4	0	95-100	90-95	85-90	60-70	25-30	5-10
	5-13	Clay, clay loam, silty clay loam.	CL	A-7	0	85-95	85-90	70-85	65-75	40-45	20-25
	13-26	Cobbly clay	CL	A-7	20-30	75-85	75-80	70-75	55-65	45-50	25-30
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 5.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
39*:											
Starman	0-3	Channery clay loam.	GC	A-6, A-7	0	60-65	55-60	50-55	40-50	35-45	15-25
	3-15	Extremely channery clay loam.	GC	A-2	0	30-35	20-25	20-25	10-20	35-45	15-25
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Starley	0-8	Loam	CL-ML	A-4	0	100	95-100	85-95	60-75	25-30	5-10
	8-15	Extremely cobbly loam.	GM-GC	A-4	45-60	80-90	70-80	55-70	35-45	25-35	5-10
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
40*:											
Tellman	0-1	Sandy loam	SM	A-2	0	85-100	85-100	65-85	25-35	15-25	NP-5
	1-10	Gravelly coarse sandy loam, gravelly sandy clay loam.	SM	A-2, A-4	0	60-75	60-75	40-60	30-40	---	NP
	10-35	Gravelly sandy clay loam.	SC	A-6	0	60-75	60-75	50-65	40-50	30-35	10-15
	35-60	Loamy coarse sand	SM	A-2	---	85-100	85-100	50-70	10-20	---	NP
Granile	0-2	Gravelly sandy loam.	SM-SC	A-2	0	80-85	70-75	50-55	25-30	25-30	5-10
	2-8	Very gravelly coarse sandy loam.	GM	A-1	10-20	60-65	55-60	35-40	20-25	---	NP
	8-12	Very gravelly sandy clay loam.	GC	A-2	10-20	65-75	40-50	35-45	30-35	35-40	15-20
	12-20	Very cobbly sandy clay loam.	GC	A-2	25-35	60-65	55-60	45-55	30-35	35-40	15-20
	20-45	Very cobbly sandy loam.	GM	A-1, A-2	40-50	75-80	70-75	40-50	20-30	---	NP
	45	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Agneston	0-2	Sandy loam	SM-SC	A-2, A-4	0	90-100	85-95	35-45	25-40	20-30	5-10
	2-7	Gravelly coarse sandy loam.	SM	A-1, A-2	5-10	70-95	60-85	25-35	15-35	---	NP
	7-22	Very cobbly sandy clay loam.	GC	A-6, A-2	35-45	65-85	55-75	40-60	25-50	30-35	10-15
	22-28	Very cobbly fine sandy loam.	GM-GC	A-2	35-45	65-85	55-75	50-60	25-35	20-30	5-10
	28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
41*:											
Tine	0-9	Very cobbly loam	CL-ML, GM-GC	A-4	45-55	90-95	85-90	75-85	60-70	25-30	5-10
	9-14	Very gravelly loamy sand, very cobbly loamy sand, very cobbly sandy loam.	GM, SM	A-1	15-60	40-60	40-60	25-50	10-15	---	NP
	14-60	Very gravelly sand, very cobbly sand, very stony sand, extremely stony sand.	GP, SP	A-1	15-60	40-60	40-60	20-50	0-5	---	NP

See footnote at end of table.

TABLE 5.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
41*:											
Fourmile--------	0-6	Loam-------------	CL-ML	A-4	0	80-100	70-90	65-75	50-60	25-30	5-10
	6-24	Very cobbly sandy clay loam.	SC, GC	A-6	35-40	70-80	60-70	50-60	40-50	30-40	10-20
	24-41	Extremely cobbly loamy coarse sand, extremely stony sand.	GP-GM	A-1	55-65	45-50	30-45	20-30	5-10	---	NP
42*:											
Tolman----------	0-4	Channery loam----	GM-GC	A-4	0	60-65	55-60	50-55	40-45	25-30	5-10
	4-15	Very channery clay loam, very gravelly loam, very gravelly sandy clay loam.	GC	A-6, A-2	5-10	50-60	40-50	30-40	25-40	20-30	10-15
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Beenom Variant--	0-6	Fine sandy loam	SM-SC, CL-ML	A-4	0	95-100	95-100	70-80	45-55	25-30	5-10
	6-23	Cobbly silty clay loam, gravelly silty clay loam, cobbly clay loam.	CL	A-6	10-30	80-90	75-90	70-80	65-75	35-40	15-20
	23-32	Gravelly silty clay loam, silty clay loam.	CL	A-6	5-10	90-100	90-100	85-90	75-85	35-40	15-20
	32	Weathered bedrock	---	---	---	---	---	---	---	---	---
Carbol Variant--	0-4	Loam-------------	CL-ML	A-4	0	90-100	90-100	75-85	60-70	20-30	5-10
	4-15	Clay loam--------	CL	A-6	0	85-100	85-100	70-85	60-70	35-40	15-20
	15	Gravelly clay loam.	CL	A-6	0	50-60	50-60	45-55	40-55	35-40	15-20
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
43*:											
Tongue River----	0-3	Loam-------------	CL-ML, ML	A-4	0	100	100	95-100	50-70	15-25	NP-10
	3-22	Sandy clay loam	SC, CL	A-6	0	100	100	60-80	45-55	25-35	10-15
	22-32	Sandy loam-------	SM-SC, SM	A-2, A-1	0	75-90	75-85	40-55	20-30	15-25	NP-10
	32	Weathered bedrock	---	---	---	---	---	---	---	---	---
Gateway---------	0-3	Loam-------------	ML	A-4	0	100	90-100	85-100	60-85	20-35	NP-10
	3-26	Silty clay, clay, clay loam.	CL, CH	A-7	0	85-100	85-100	85-100	80-95	40-70	20-40
	26	Weathered bedrock	---	---	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	In/hr	In/in	pH				Pct
10*:									
Agneston	0-2	10-16	2.0-6.0	0.11-0.13	5.1-5.5	Low	0.20	2	3-5
	2-7	7-12	2.0-6.0	0.10-0.12	4.5-6.0	Low	0.15		
	7-22	20-25	0.2-0.6	0.10-0.12	4.5-5.5	Moderate	0.10		
	22-28	10-16	2.0-6.0	0.09-0.10	5.6-6.0	Low	0.10		
	28	---	---	---	---	---	----		
Granile	0-2	17-20	2.0-6.0	0.10-0.12	5.1-6.0	Low	0.15	3	2-3
	2-8	5-10	2.0-6.0	0.08-0.10	5.1-6.0	Low	0.10		
	8-12	25-30	0.6-2.0	0.10-0.11	5.1-6.0	Moderate	0.10		
	12-20	25-30	0.6-2.0	0.10-0.11	5.1-6.0	Moderate	0.10		
	20-45	5-10	2.0-6.0	0.07-0.09	5.1-6.0	Low	0.05		
	45	---	---	---	---	---	----		
Rock outcrop.									
11*:									
Agneston	0-2	10-16	2.0-6.0	0.11-0.13	5.1-5.5	Low	0.20	2	3-5
	2-7	7-12	2.0-6.0	0.10-0.12	4.5-6.0	Low	0.15		
	7-22	20-25	0.2-0.6	0.10-0.12	4.5-5.5	Moderate	0.10		
	22-28	10-16	2.0-6.0	0.09-0.10	5.6-6.0	Low	0.10		
	28	---	---	---	---	---	----		
Leighcan	0-6	10-20	2.0-6.0	0.14-0.16	5.1-6.0	Low	0.20	3	.5-1
	6-20	5-10	2.0-6.0	0.07-0.09	5.1-5.5	Low	0.05		
	20-30	5-10	2.0-6.0	0.05-0.07	5.1-5.5	Low	0.05		
	30-42	0-5	6.0-20.0	0.03-0.04	5.1-6.0	Low	0.02		
	42	---	---	---	---	---	----		
12*:									
Chilton Variant	0-3	16-22	0.6-2.0	0.10-0.12	7.9-8.4	Low	0.10	3	<1
	3-12	12-18	0.6-2.0	0.09-0.10	7.9-9.0	Low	0.10		
	12-42	12-18	0.6-2.0	0.06-0.08	7.9-9.0	Low	0.05		
Sunup	0-4	10-15	2.0-6.0	0.03-0.05	7.9-9.0	Low	0.05	1	1-2
	4-10	10-15	2.0-6.0	0.03-0.05	7.9-9.0	Low	0.05		
	10	---	---	---	---	---	----		
Spearfish Variant	0-4	18-23	0.6-2.0	0.14-0.16	7.9-8.4	Low	0.17	1	1-2
	4-14	20-24	0.6-2.0	0.16-0.18	7.9-8.4	Low	0.28		
	14	---	---	---	---	---	----		
13*. Cirque land									
14 Cloud Peak	0-2	24-27	0.6-2.0	0.15-0.17	6.1-7.3	Low	0.32	2	1-3
	2-22	27-35	0.6-2.0	0.09-0.11	6.1-7.8	Moderate	0.28		
	22-38	24-27	0.6-2.0	0.05-0.07	7.4-8.4	Low	0.05		
	38	---	---	---	---	---	----		
15*:									
Cloud Peak	0-2	24-27	0.6-2.0	0.15-0.17	6.1-7.3	Low	0.32	2	1-3
	2-22	27-35	0.6-2.0	0.09-0.11	6.1-7.8	Moderate	0.28		
	22-38	24-27	0.6-2.0	0.05-0.07	7.4-8.4	Low	0.05		
	38	---	---	---	---	---	----		
Eutroboralfs.									
Argiborolls.									

See footnote at end of table.

TABLE 6.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
							K	T	
	In	Pct	In/hr	In/in	pH				Pct
16*. Cryaquolls									
17*:									
Farlow----------	0-8	20-25	0.6-2.0	0.12-0.14	7.4-8.4	Low------------	0.15	3	2-3
	8-16	27-35	0.6-2.0	0.10-0.12	7.4-8.4	Low------------	0.15		
	16-45	20-30	0.6-2.0	0.03-0.07	7.9-8.4	Low------------	0.28		
Pishkun---------	0-7	10-27	0.6-2.0	0.09-0.11	6.6-7.8	Low------------	0.10	3	2-4
	7-42	18-35	0.6-2.0	0.04-0.05	7.9-8.4	Low------------	0.05		
18--------------- Fourmile	0-6	15-25	0.6-2.0	0.12-0.15	5.6-7.3	Low------------	0.20	3	2-3
	6-24	25-35	0.6-2.0	0.04-0.06	5.6-7.3	Moderate--------	0.05		
	24-41	2-6	>20.0	0.02-0.04	5.6-7.3	Low------------	0.05		
19*:									
Frisco----------	0-2	10-20	2.0-6.0	0.10-0.13	5.1-7.3	Low------------	0.24	5	1-2
	2-14	16-19	2.0-6.0	0.10-0.11	5.1-7.3	Low------------	0.10		
	14-50	18-30	0.6-2.0	0.05-0.09	5.1-7.3	Moderate--------	0.15		
	50-60	5-10	2.0-6.0	0.06-0.07	5.1-7.3	Low------------	0.05		
Troutville------	0-12	7-15	>2.0	0.05-0.08	5.6-7.3	Low------------	0.15	5	.5-1
	12-45	5-15	>2.0	0.05-0.07	5.6-7.3	Low------------	0.10		
20--------------- Grobutte	0-10	15-25	0.6-2.0	0.12-0.14	7.9-8.4	Low------------	0.15	5	2-4
	10-41	15-25	0.6-2.0	0.10-0.11	7.9-8.4	Low------------	0.05		
21*:									
Hanson----------	0-41	15-27	0.6-2.0	0.11-0.13	6.6-9.0	Low------------	0.10	2	3-6
Raynesford------	0-12	18-27	0.6-2.0	0.16-0.20	7.4-8.4	Low------------	0.32	5	3-6
	12-31	18-35	0.2-0.6	0.13-0.16	7.9-8.4	Low------------	0.28		
	31-41	10-27	0.2-0.6	0.09-0.11	7.9-8.4	Low------------	0.10		
22*:									
Hanson Variant--	0-9	22-24	0.6-2.0	0.15-0.16	7.4-7.8	Low------------	0.15	2	2-3
	9-24	18-25	0.6-2.0	0.11-0.13	7.4-7.8	Low------------	0.10		
	24	---	---	---	---	---------------	----		
Starley---------	0-8	18-27	0.6-2.0	0.09-0.12	6.6-8.4	Low------------	0.10	1	1-3
	8-15	18-27	0.6-2.0	0.04-0.06	6.6-8.4	Low------------	0.02		
	15	---	---	---	---	---------------	----		
23*:									
Inchau----------	0-7	15-27	0.6-2.0	0.16-0.18	6.1-7.8	Low------------	0.32	3	2-5
	7-20	27-35	0.2-0.6	0.18-0.20	6.1-7.8	Moderate--------	0.32		
	20-28	20-35	0.6-2.0	0.11-0.15	6.1-7.8	Moderate--------	0.28		
	28	---	---	---	---	---------------	----		
Carbol----------	0-6	15-20	0.6-2.0	0.16-0.18	5.6-7.3	Low------------	0.32	1	2-4
	6-12	20-35	2.0-6.0	0.10-0.12	5.6-7.3	Low------------	0.17		
	12	---	---	---	---	---------------	----		
24*:									
Leavitt---------	0-3	15-20	0.6-2.0	0.19-0.21	6.6-7.8	Low------------	0.43	5	2-4
	3-12	15-20	0.6-2.0	0.19-0.21	6.6-7.8	Low------------	0.49		
	12-25	25-35	0.6-2.0	0.19-0.21	6.1-7.8	Moderate--------	0.32		
	25-44	27-32	0.2-0.6	0.16-0.18	7.4-8.4	Moderate--------	0.20		
Passcreek-------	0-7	15-20	0.6-2.0	0.16-0.18	6.1-7.3	Low------------	0.32	2	2-3
	7-12	20-32	0.6-2.0	0.16-0.21	6.6-7.8	Moderate--------	0.37		
	12-19	15-30	0.6-2.0	0.12-0.14	7.9-8.4	Moderate--------	0.28		
	19-30	15-20	0.6-2.0	0.12-0.14	7.9-8.4	Low------------	0.15		
	30	---	---	---	---	---------------	----		

See footnote at end of table.

TABLE 6.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	In/hr	In/in	pH				Pct
25*:									
Lucky----------	0-7	12-15	0.6-2.0	0.14-0.16	5.6-7.8	Low------------	0.20	2	2-4
	7-20	20-35	0.6-2.0	0.10-0.13	5.6-7.8	Moderate-------	0.24		
	20-30	2-5	6.0-20.0	0.04-0.06	5.6-7.8	Low------------	0.05		
	30	---	---	---	---	---------------	----		
Burgess---------	0-3	8-15	0.6-2.0	0.16-0.18	5.1-7.3	Low------------	0.32	3	2-3
	3-29	8-15	>6.0	0.07-0.09	5.1-6.5	Low------------	0.17		
	29	---	---	---	---	---------------	----		
Hazton----------	0-7	15-19	2.0-6.0	0.10-0.12	6.1-7.3	Low------------	0.15	1	1-2
	7-13	10-15	2.0-6.0	0.07-0.09	6.1-7.3	Low------------	0.15		
	13	---	---	---	---	---------------	----		
26*:									
Mirror----------	0-10	18-22	0.6-2.0	0.13-0.15	4.5-5.5	Moderate-------	0.15	3	3-5
	10-33	20-25	0.6-2.0	0.12-0.13	4.5-5.5	Moderate-------	0.10		
	33	---	---	---	---	---------------	----		
Teewinot--------	0-17	5-15	2.0-6.0	0.04-0.06	5.1-6.0	Low------------	0.02	1	1-3
	17	---	---	---	---	---------------	----		
Bross-----------	0-2	10-15	0.6-2.0	0.14-0.16	4.5-5.5	Low------------	0.17	5	3-5
	2-27	19-23	0.6-2.0	0.10-0.12	4.5-5.5	Moderate-------	0.10		
	27-42	12-18	2.0-6.0	0.04-0.07	4.5-6.0	Low------------	0.10		
27*:									
Nathrop---------	0-8	15-25	0.6-2.0	0.16-0.18	6.6-7.8	Low------------	0.28	2	2-4
	8-38	27-35	0.6-2.0	0.12-0.14	6.6-7.8	Low------------	0.32		
	38	---	---	---	---	---------------	----		
Passcreek-------	0-7	15-20	0.6-2.0	0.16-0.18	6.6-7.3	Low------------	0.32	2	2-3
	7-12	20-32	0.6-2.0	0.16-0.21	6.6-7.8	Moderate-------	0.37		
	12-19	15-30	0.6-2.0	0.12-0.14	7.9-8.4	Moderate-------	0.28		
	19-30	15-20	0.6-2.0	0.12-0.14	7.9-8.4	Low------------	0.15		
	30	---	---	---	---	---------------	----		
Starley---------	0-8	18-27	0.6-2.0	0.09-0.12	6.6-8.4	Low------------	0.10	1	1-3
	8-15	18-27	0.6-2.0	0.04-0.06	6.6-8.4	Low------------	0.02		
	15	---	---	---	---	---------------	----		
28*:									
Nathrop Variant-	0-7	15-25	0.6-2.0	0.13-0.15	6.1-7.3	Low------------	0.24	2	2-3
	7-22	26-30	0.2-0.6	0.08-0.09	6.6-7.8	Moderate-------	0.10		
	22	---	---	---	---	---------------	----		
Nielsen---------	0-10	20-25	0.6-2.0	0.14-0.16	6.1-7.3	Moderate-------	0.17	1	1-3
	10-18	27-33	0.2-0.6	0.12-0.13	6.6-7.8	Moderate-------	0.10		
	18	---	---	---	---	---------------	----		
Passcreek-------	0-7	15-20	0.6-2.0	0.16-0.18	6.6-7.3	Low------------	0.32	2	2-3
	7-12	20-32	0.6-2.0	0.16-0.21	6.6-7.8	Moderate-------	0.37		
	12-19	15-30	0.6-2.0	0.12-0.14	7.9-8.4	Moderate-------	0.28		
	19-30	15-20	0.6-2.0	0.12-0.14	7.9-8.4	Low------------	0.15		
	30	---	---	---	---	---------------	----		
29*:									
Owen Creek------	0-4	30-35	0.2-0.6	0.19-0.21	6.1-7.8	Moderate-------	0.32	2	1-3
	4-17	40-50	0.06-0.2	0.14-0.16	6.1-7.8	High-----------	0.24		
	17-24	40-50	0.06-0.2	0.12-0.13	7.4-8.4	High-----------	0.15		
	24	---	---	---	---	---------------	----		
Echemoor--------	0-14	18-25	0.6-2.0	0.16-0.18	5.6-7.3	Low------------	0.32	3	2-3
	14-33	27-32	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-------	0.43		
	33	---	---	---	---	---------------	----		

See footnote at end of table.

TABLE 6.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	In/hr	In/in	pH				Pct
29*:									
Bynum	0-7	20-27	0.6-2.0	0.18-0.22	6.6-7.8	Low	0.32	2	2-5
	7-11	20-35	0.6-2.0	0.14-0.18	7.2-8.4	Moderate	0.32		
	11-27	20-35	0.6-2.0	0.12-0.15	6.6-7.8	Moderate	0.32		
	27	---	---	---	---	---	---		
30*:									
Owen Creek	0-4	30-35	0.2-0.6	0.19-0.21	6.1-7.8	Moderate	0.32	2	1-3
	4-17	40-50	0.06-0.2	0.14-0.16	6.1-7.8	High	0.24		
	17-24	40-50	0.06-0.2	0.12-0.13	7.4-8.4	High	0.15		
	24	---	---	---	---	---	---		
Waybe	0-3	40-55	0.06-0.2	0.12-0.14	7.4-8.4	High	0.17	1	.5-2
	3-16	35-50	0.06-0.2	0.13-0.15	7.4-8.4	High	0.32		
	16	---	---	---	---	---	---		
31*:									
Rock outcrop.									
Agneston	0-2	10-16	2.0-6.0	0.11-0.13	5.1-5.5	Low	0.20	2	3-5
	2-7	7-12	2.0-6.0	0.10-0.12	4.5-6.0	Low	0.15		
	7-22	20-25	0.2-0.6	0.10-0.12	4.5-5.5	Moderate	0.10		
	22-28	10-16	2.0-6.0	0.09-0.10	5.6-6.0	Low	0.10		
	28	---	---	---	---	---	---		
Rubble land.									
32*:									
Rock outcrop.									
Cloud Peak	0-2	24-27	0.6-2.0	0.15-0.17	6.1-7.3	Low	0.32	2	1-3
	2-22	27-35	0.6-2.0	0.09-0.11	6.1-7.8	Moderate	0.28		
	22-38	24-27	0.6-2.0	0.05-0.07	7.4-8.4	Low	0.05		
	38	---	---	---	---	---	---		
33*:									
Rock outcrop.									
Mirror	0-10	18-22	0.6-2.0	0.13-0.15	4.5-5.5	Moderate	0.15	3	3-5
	10-33	20-25	0.6-2.0	0.12-0.13	4.5-5.5	Moderate	0.10		
	33	---	---	---	---	---	---		
Teewinot	0-17	5-15	2.0-6.0	0.04-0.06	5.1-6.0	Low	0.02	1	1-3
	17	---	---	---	---	---	---		
34*:									
Rock outcrop.									
Starman	0-3	27-35	0.2-0.6	0.15-0.17	7.4-8.4	Moderate	0.15	1	1-2
	3-15	27-35	0.2-0.6	0.11-0.11	7.9-8.4	Moderate	0.10		
	15	---	---	---	---	---	---		
35*:									
Rock outcrop.									
Starman Variant	0-2	18-23	0.6-2.0	0.10-0.12	7.4-8.4	Low	0.10	1	<1
	2-11	20-26	0.6-2.0	0.04-0.06	7.4-8.4	Moderate	0.10		
	11	---	---	---	---	---	---		
36*:									
Rock outcrop.									
Teewinot	0-17	5-15	2.0-6.0	0.04-0.06	5.1-6.0	Low	0.02	1	1-3
	17	---	---	---	---	---	---		

See footnote at end of table.

TABLE 6.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	In/hr	In/in	pH				Pct
36*:									
Agneston	0-2	10-16	2.0-6.0	0.11-0.13	5.1-5.5	Low	0.20	2	3-5
	2-7	7-12	2.0-6.0	0.10-0.12	4.5-6.0	Low	0.15		
	7-22	20-25	0.2-0.6	0.10-0.12	4.5-5.5	Moderate	0.10		
	22-28	10-16	2.0-6.0	0.09-0.10	5.6-6.0	Low	0.10		
	28	---	---	---	---	-------	----		
37*. Rubble land									
38*:									
Sapphire	0-13	15-20	2.0-6.0	0.12-0.14	5.6-6.5	Low	0.24	2	1-3
	13-23	25-35	0.6-2.0	0.13-0.15	6.1-7.3	Moderate	0.32		
	23-31	25-35	0.6-2.0	0.11-0.13	6.1-7.3	Moderate	0.17		
	31	---	---	---	---	-------	----		
Bottle	0-8	10-15	2.0-6.0	0.11-0.13	4.5-6.0	Low	0.15	2	1-3
	8-15	5-10	6.0-20.0	0.07-0.11	4.5-6.0	Low	0.10		
	15-27	2-5	>20.0	0.04-0.05	4.5-6.0	Low	0.05		
	27	---	---	---	---	-------	----		
Foxton	0-5	20-25	0.6-2.0	0.16-0.17	5.6-6.5	Low	0.32	2	1-3
	5-13	45-50	0.06-0.2	0.13-0.15	6.6-7.8	High	0.32		
	13-26	50-55	0.06-0.2	0.11-0.13	6.6-7.8	High	0.10		
	26	---	---	---	---	-------	----		
39*:									
Starman	0-3	27-35	0.2-0.6	0.15-0.17	7.4-8.4	Moderate	0.15	1	1-2
	3-15	27-35	0.2-0.6	0.11-0.11	7.9-8.4	Moderate	0.10		
	15	---	---	---	---	-------	----		
Starley	0-8	18-27	0.6-2.0	0.09-0.12	6.6-8.4	Low	0.10	1	1-3
	8-15	18-27	0.6-2.0	0.04-0.06	6.6-8.4	Low	0.02		
	15	---	---	---	---	-------	----		
40*:									
Tellman	0-1	5-15	2.0-6.0	0.11-0.13	4.5-5.5	Low	0.28	5	.5-1
	1-10	10-22	0.6-2.0	0.08-0.10	4.5-5.5	Low	0.10		
	10-35	20-28	0.6-2.0	0.09-0.12	5.1-5.5	Moderate	0.20		
	35-60	2-6	6.0-20.0	0.05-0.07	5.1-6.5	Low	0.15		
Granile	0-2	17-20	2.0-6.0	0.10-0.12	5.1-6.0	Low	0.15	3	2-3
	2-8	5-10	2.0-6.0	0.08-0.10	5.1-6.0	Low	0.10		
	8-12	25-30	0.6-2.0	0.10-0.11	5.1-6.0	Moderate	0.10		
	12-20	25-30	0.6-2.0	0.10-0.11	5.1-6.0	Moderate	0.10		
	20-45	5-10	2.0-6.0	0.07-0.09	5.1-6.0	Low	0.05		
	45	---	---	---	---	-------	----		
Agneston	0-2	10-16	2.0-6.0	0.11-0.13	5.1-5.5	Low	0.20	2	3-5
	2-7	7-12	2.0-6.0	0.10-0.12	4.5-6.0	Low	0.15		
	7-22	20-25	0.2-0.6	0.10-0.12	4.5-5.5	Moderate	0.10		
	22-28	10-16	2.0-6.0	0.09-0.10	5.6-6.0	Low	0.10		
	28	---	---	---	---	-------	----		
41*:									
Tine	0-9	18-22	0.6-2.0	0.12-0.13	6.1-7.8	Low	0.10	3	1-3
	9-14	5-10	6.0-20.0	0.05-0.07	6.1-7.8	Low	0.10		
	14-60	0-5	>20.0	0.03-0.05	6.1-7.8	Low	0.10		
Fourmile	0-6	15-25	0.6-2.0	0.12-0.15	5.6-7.3	Low	0.20	3	2-3
	6-24	25-35	0.6-2.0	0.04-0.06	5.6-7.3	Moderate	0.05		
	24-41	2-6	>20.0	0.02-0.04	5.6-7.3	Low	0.05		

See footnote at end of table.

TABLE 6.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
							K	T	
	In	Pct	In/hr	In/in	pH				Pct
42*:									
Tolman----------	0-4	18-22	0.6-2.0	0.13-0.14	6.1-7.8	Low------------	0.15	1	2-4
	4-15	20-35	0.6-2.0	0.05-0.11	6.1-7.8	Low------------	0.24		
	15	---	---	---	---	---------------	----		
Beenom Variant--	0-6	17-19	2.0-6.0	0.13-0.15	6.6-7.3	Low------------	0.37	2	2-3
	6-23	30-34	0.2-0.6	0.17-0.18	6.6-7.3	Moderate-------	0.15		
	23-32	30-34	0.2-0.6	0.17-0.19	7.4-7.8	Moderate-------	0.28		
	32	---	---	---	---	---------------	----		
Carbol Variant--	0-4	10-20	0.6-2.0	0.16-0.18	7.4-7.8	Low------------	0.32	1	1-2
	4-15	28-35	0.6-2.0	0.18-0.20	7.4-7.8	Moderate-------	0.32		
	15	28-32	0.6-2.0	0.10-0.12	7.4-7.8	Moderate-------	0.15		
	15	---	---	---	---	---------------	----		
43*:									
Tongue River----	0-3	10-20	0.6-2.0	0.15-0.17	5.6-7.3	Low------------	0.37	2	.5-1
	3-22	20-30	0.6-2.0	0.14-0.16	5.6-7.3	Low------------	0.28		
	22-32	1-20	2.0-6.0	0.10-0.12	5.6-7.3	Low------------	0.15		
	32	---	---	---	---	---------------	----		
Gateway---------	0-3	20-27	0.6-2.0	0.16-0.18	5.6-7.3	Low------------	0.28	2	1-2
	3-26	35-45	0.06-0.2	0.14-0.16	5.6-7.3	High-----------	0.32		
	26	---	---	---	---	---------------	----		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--SOIL AND WATER FEATURES

[The symbol > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydrologic group	Bedrock		Potential frost action	Risk of corrosion	
		Depth	Hardness		Uncoated steel	Concrete
		In				
10*:						
Agneston	C	20-40	Hard	Moderate	High	High.
Granile	B	40-60	Hard	Moderate	Moderate	Moderate.
Rock outcrop.						
11*:						
Agneston	C	20-40	Hard	Moderate	High	High.
Leighcan	B	40-60	Hard	High	High	High.
12*:						
Chilton Variant	B	40-60	Hard	Low	High	Moderate.
Sunup	D	10-20	Hard	Low	High	Low.
Spearfish Variant	D	10-20	Soft	Low	High	High.
13*. Cirque land						
14 Cloud Peak	C	20-40	Hard	Moderate	High	Low.
15*:						
Cloud Peak	C	20-40	Hard	Moderate	High	Low.
Eutroboralfs.						
Argiborolls.						
16*. Cryaquolls						
17*:						
Farlow	C	40-60	Hard	Low	Moderate	Low.
Pishkun	B	>60	---	Moderate	High	Low.
18 Fourmile	B	>60	---	Low	Moderate	Moderate.
19*:						
Frisco	B	>60	---	Moderate	Moderate	Moderate.
Troutville	B	>60	---	Low	Moderate	Low.
20 Grobutte	B	>60	---	Moderate	Moderate	Low.
21*:						
Hanson	B	>60	---	Moderate	High	Low.
Raynesford	B	>60	---	Moderate	High	Low.
22*:						
Hanson Variant	C	20-40	Hard	Moderate	Moderate	Moderate.
Starley	D	7-20	Hard	Low	High	Low.

See footnote at end of table.

TABLE 7.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Bedrock		Potential frost action	Risk of corrosion	
		Depth	Hardness		Uncoated steel	Concrete
		In				
23*:						
Inchau	C	20-40	Soft	Moderate	Moderate	Low.
Carbol	D	10-20	Hard	Moderate	Moderate	Low.
24*:						
Leavitt	B	>60	---	Moderate	High	Low.
Passcreek	C	20-40	Hard	Moderate	High	Low.
25*:						
Lucky	C	20-40	Hard	Moderate	Moderate	Low.
Burgess	C	20-40	Hard	Moderate	Moderate	Moderate.
Hazton	D	10-20	Hard	Moderate	Moderate	Low.
26*:						
Mirror	C	20-40	Hard	Moderate	High	High.
Teewinot	D	10-20	Hard	Moderate	Moderate	Moderate.
Bross	B	>60	---	Moderate	High	High.
27*:						
Nathrop	C	20-40	Hard	Moderate	High	Moderate.
Passcreek	C	20-40	Hard	Moderate	High	Low.
Starley	D	7-20	Hard	Low	High	Low.
28*:						
Nathrop Variant	C	20-40	Hard	Moderate	Moderate	Low.
Nielsen	D	10-20	Hard	Moderate	Moderate	Low.
Passcreek	C	20-40	Hard	Moderate	High	Low.
29*:						
Owen Creek	C	20-40	Soft	Moderate	Moderate	Low.
Echemoor	C	20-40	Soft	Moderate	Moderate	Low.
Bynum	C	20-40	Soft	Moderate	High	Low.
30*:						
Owen Creek	C	20-40	Soft	Moderate	Moderate	Low.
Waybe	D	10-20	Soft	Moderate	High	Low.
31*:						
Rock outcrop.						
Agneston	C	20-40	Hard	Moderate	High	High.
Rubble land.						
32*:						
Rock outcrop.						
Cloud Peak	C	20-40	Hard	Moderate	High	Low.
33*:						
Rock outcrop.						
Mirror	C	20-40	Hard	Moderate	High	High.

See footnote at end of table.

TABLE 7.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Bedrock		Potential frost action	Risk of corrosion	
		Depth	Hardness		Uncoated steel	Concrete
		In				
33*:						
Teewinot	D	10-20	Hard	Moderate	Moderate	Moderate.
34*:						
Rock outcrop.						
Starman	D	10-20	Hard	Moderate	Moderate	Low.
35*:						
Rock outcrop.						
Starman Variant	D	10-20	Hard	Low	High	Low.
36*:						
Rock outcrop.						
Teewinot	D	10-20	Hard	Moderate	Moderate	Moderate.
Agneston	C	20-40	Hard	Moderate	High	High.
37*.						
Rubble land						
38*:						
Sapphire	C	20-40	Hard	Moderate	Moderate	Moderate.
Bottle	C	20-40	Hard	Low	High	High.
Foxton	C	20-40	Hard	Low	Moderate	Moderate.
39*:						
Starman	D	10-20	Hard	Moderate	Moderate	Low.
Starley	D	7-20	Hard	Low	High	Low.
40*:						
Tellman	B	>60	---	Moderate	High	High.
Granile	B	40-60	Hard	Moderate	Moderate	Moderate.
Agneston	C	20-40	Hard	Moderate	High	High.
41*:						
Tine	A	>60	---	Low	Moderate	Low.
Fourmile	B	>60	---	Low	Moderate	Moderate.
42*:						
Tolman	D	10-20	Hard	Moderate	Moderate	Low.
Beenom Variant	C	20-40	Soft	Moderate	Moderate	Low.
Carbol Variant	D	10-20	Hard	Moderate	Moderate	Low.
43*:						
Tongue River	C	20-40	Soft	Moderate	Moderate	Moderate.
Gateway	C	20-40	Soft	Moderate	High	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Agneston	Loamy-skeletal, mixed Typic Cryoboralfs
Argiborolls	Argiborolls
Beenom Variant	Fine-loamy, mixed Typic Argiborolls
Bottle	Sandy, mixed Dystric Cryochrepts
Bross	Loamy-skeletal, mixed Pergelic Cryumbrepts
Burgess	Coarse-loamy, mixed Argic Cryoborolls
Bynum	Fine-loamy, mixed Typic Cryoborolls
Carbol	Loamy, mixed Argic Lithic Cryoborolls
Carbol Variant	Loamy, mixed Lithic Argiborolls
Chilton Variant	Loamy-skeletal, mixed (calcareous), mesic Ustic Torriorthents
Cloud Peak	Loamy-skeletal, mixed Typic Cryoboralfs
Cryaquolls	Cryaquolls
Echemoor	Fine-loamy, mixed Argic Pachic Cryoborolls
Eutroboralfs	Eutroboralfs
Farlow	Loamy-skeletal, mixed Typic Cryoborolls
Fourmile	Loamy-skeletal, mixed Argic Cryoborolls
Foxton	Fine, montmorillonitic Typic Cryoboralfs
Frisco	Loamy-skeletal, mixed Typic Cryoboralfs
Gateway	Fine, montmorillonitic Typic Cryoboralfs
Granile	Loamy-skeletal, mixed Typic Cryoboralfs
Grobutte	Loamy-skeletal, mixed (calcareous), frigid Ustic Torriorthents
Hanson	Loamy-skeletal, carbonatic Calcic Cryoborolls
Hanson Variant	Loamy-skeletal, carbonatic Calcic Cryoborolls
Hazton	Loamy, mixed Lithic Cryoborolls
Inchau	Fine-loamy, mixed Argic Cryoborolls
Leavitt	Fine-loamy, mixed Argic Cryoborolls
Leighcan	Loamy-skeletal, mixed Dystric Cryochrepts
Lucky	Fine-loamy, mixed Argic Cryoborolls
Mirror	Loamy-skeletal, mixed Pergelic Cryumbrepts
Nathrop	Loamy-skeletal, mixed Argic Cryoborolls
Nathrop Variant	Loamy-skeletal, mixed Argic Cryoborolls
Nielsen	Loamy-skeletal, mixed Argic Lithic Cryoborolls
Owen Creek	Fine, montmorillonitic Argic Cryoborolls
Passcreek	Fine-loamy, mixed Argic Cryoborolls
Pishkun	Loamy-skeletal, mixed (calcareous) Typic Cryorthents
Raynesford	Fine-loamy, carbonatic Calcic Cryoborolls
Sapphire	Fine-loamy, mixed Typic Cryoboralfs
Spearfish Variant	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Starley	Loamy-skeletal, mixed Lithic Cryoborolls
Starman	Loamy-skeletal, mixed (calcareous) Lithic Cryorthents
Starman Variant	Loamy-skeletal, mixed (calcareous), frigid Lithic Ustic Torriorthents
Sunup	Loamy-skeletal, mixed (calcareous), mesic Lithic Ustic Torriorthents
Teewinot	Loamy-skeletal, mixed Lithic Cryumbrepts
Tellman	Fine-loamy over sandy or sandy-skeletal, mixed Typic Cryoboralfs
Tine	Sandy-skeletal, mixed Typic Cryoborolls
Tolman	Loamy-skeletal, mixed Lithic Argiborolls
Tongue River	Fine-loamy, mixed Typic Cryoboralfs
Troutville	Loamy-skeletal, mixed Psammentic Cryoboralfs
Waybe	Clayey, mixed (calcareous), shallow Typic Cryorthents

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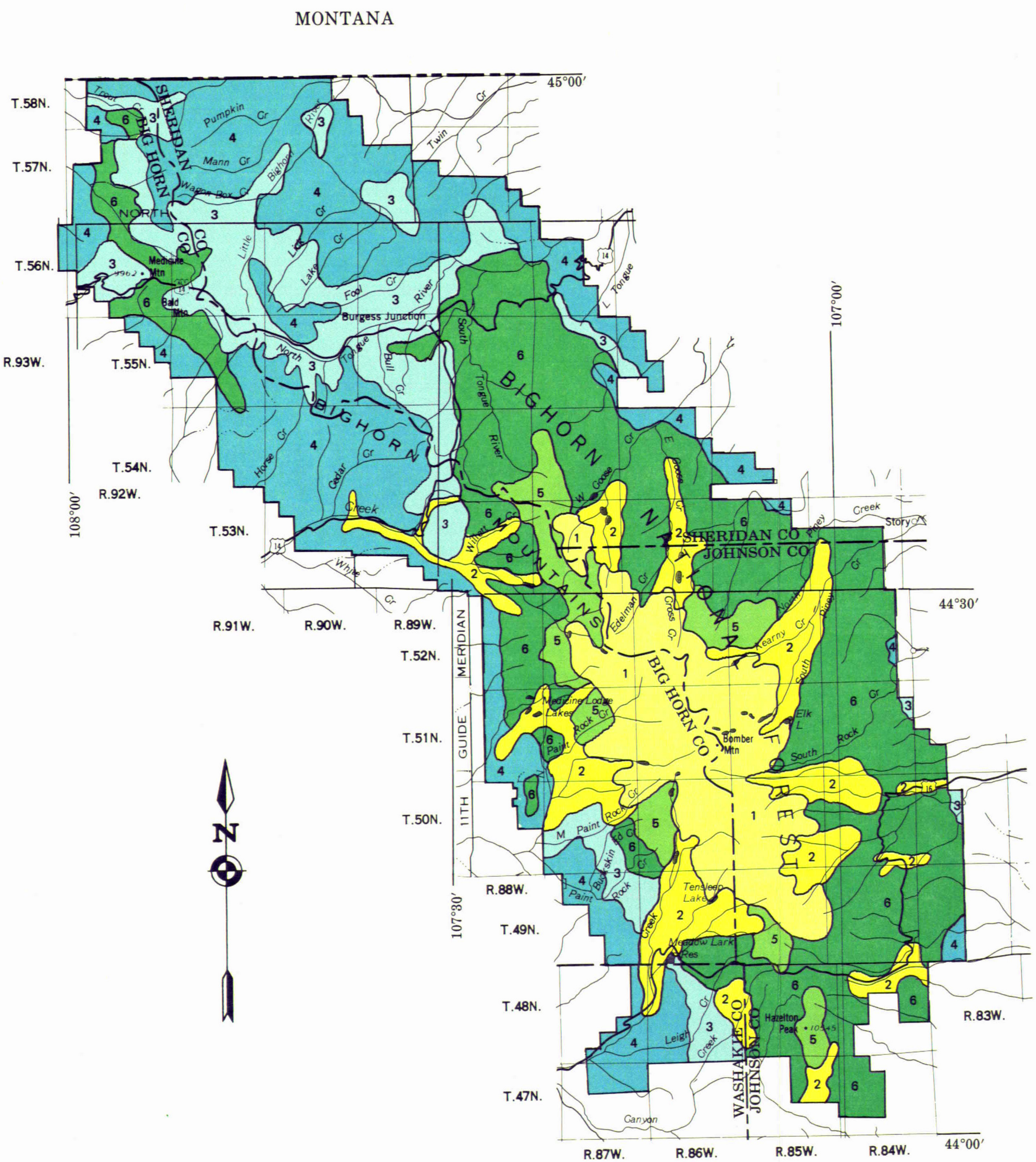


U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
SOIL CONSERVATION SERVICE
WYOMING AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

BIGHORN NATIONAL FOREST, WYOMING
PARTS OF BIG HORN, JOHNSON, SHERIDAN, AND WASHAKIE COUNTIES

Scale 1:500,000

0 10 Miles

1 inch equals approximately 8 miles

MAP UNITS

1 — Rubble land - Rock outcrop - Cirque land: Miscellaneous areas on moderately sloping to nearly vertical mountain slopes near or above timberline.

2 — Frisco - Troutville - Fourmile: Deep, well drained soils that formed in glacial till and alluvium derived from granite on moraines and old terraces.

3 — Owen Creek - Tongue River - Gateway: Moderately deep, well drained soils that formed in material derived from interbedded shale, sandstone, and limestone on mountain slopes and landslide deposits.

4 — Cloud Peak - Starley - Rock outcrop: Moderately deep and shallow, well drained soils that formed in material derived from limestone on mountain slopes and ridges.

5 — Rock outcrop - Mirror - Teewinot: Moderately deep and shallow, well drained soils that formed in material derived from granite on mountain slopes and ridges near timberline.

6 — Agneston - Granile - Rock outcrop: Moderately deep and deep, well drained soils that formed in material derived from granite on mountain slopes.

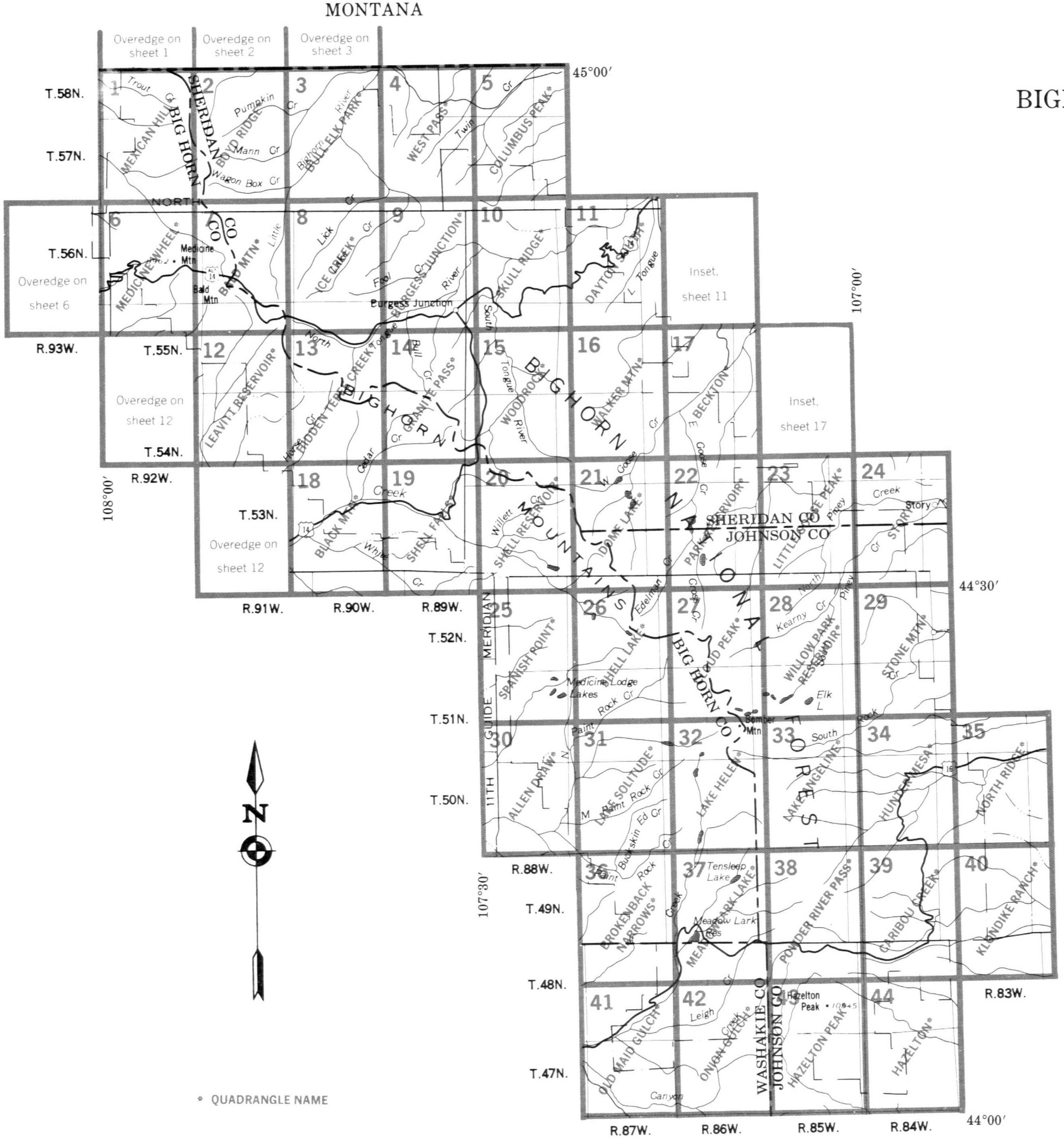
INDEX TO MAP SHEETS

BIGHORN NATIONAL FOREST, WYOMING

Scale 1:500,000

0 10 Miles

1 inch equals approximately 8 miles



SOIL LEGEND

Symbol	Name
10	Agneston - Granile - Rock outcrop association, 5 to 50 percent slopes
11	Agneston - Leighcan association, 5 to 30 percent slopes
12	Chilton Variant - Sunup - Spearfish Variant association, 5 to 60 percent slopes
13	Cirque land, 10 to 130 percent slopes
14	Cloud Peak gravelly silt loam, 5 to 45 percent slopes
15	Cloud Peak - Eutroboralfs - Argiborolls association, 10 to 65 percent slopes
16	Cryaquolls, 0 to 5 percent slopes
17	Farlow - Pishkun association, 5 to 40 percent slopes
18	Fourmile loam, 2 to 30 percent slopes
19	Frisco - Troutville association, 2 to 40 percent slopes
20	Grobutte very gravelly loam, 8 to 60 percent slopes
21	Hanson - Raynesford association, 0 to 30 percent slopes
22	Hanson Variant - Starley association, 10 to 60 percent slopes
23	Inchau - Carbol association, 2 to 20 percent slopes
24	Leavitt - Passcreek association, 2 to 30 percent slopes
25	Lucky - Burgess - Hazton association, 2 to 30 percent slopes
26	Mirror - Teewinot - Bross association, 2 to 40 percent slopes
27	Nathrop - Passcreek - Starley association, 2 to 30 percent slopes
28	Nathrop Variant - Nielsen - Passcreek association, 20 to 35 percent slopes
29	Owen Creek - Echemoor - Bynum association, 2 to 30 percent slopes
30	Owen Creek - Waybe association, 5 to 35 percent slopes
31	Rock outcrop - Agneston - Rubble land association, 5 to 60 percent slopes
32	Rock outcrop - Cloud Peak association, 10 to 70 percent slopes
33	Rock outcrop - Mirror - Teewinot association, 5 to 35 percent slopes
34	Rock outcrop - Starman association, 5 to 70 percent slopes
35	Rock outcrop - Starman Variant association, 10 to 70 percent slopes
36	Rock outcrop - Teewinot - Agneston association, 5 to 35 percent slopes
37	Rubble land, 5 to 50 percent slopes
38	Sapphire - Bottle - Foxton association, 2 to 35 percent slopes
39	Starman - Starley association, 2 to 30 percent slopes
40	Tellman - Granile - Agneston association, 2 to 20 percent slopes
41	Tine - Fourmile association, 2 to 30 percent slopes.
42	Tolman - Beenom Variant - Carbol Variant association, 5 to 35 percent slopes
43	Tongue River - Gateway association, 2 to 35 percent slopes

SPECIAL SYMBOLS LEGEND

WATER FEATURES

LAKES, PONDS AND RESERVOIRS

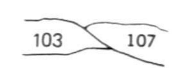
Perennial

MISCELLANEOUS WATER FEATURES

Marsh or Swamp

SPECIAL SYMBOLS FOR SOIL SURVEY

Soil Delineations and Symbols



Slide or Slip (tips point upslope)

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 1

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 9, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

QUADRANGLE LOCATION

MEXICAN HILL, WYO.
N4452.5—W10752.5/7.5

This map was compiled by U.S. Department of Agriculture–Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 2

SCALE 1:24 000

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 9, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

NORTH

WYOMING

QUADRANGLE LOCATION

BOYD RIDGE, WYO.
N4452.5—W10745/7.5

This map was compiled by U.S. Department of Agriculture—Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

Sheet No. 2 of 44

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 3

SCALE 1:24 000

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 9, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

WYOMING
QUADRANGLE LOCATION

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BULL ELK PARK, WYO.
N4452.5–W10737.5/7.5

SCALE 1:24 000

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 9, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

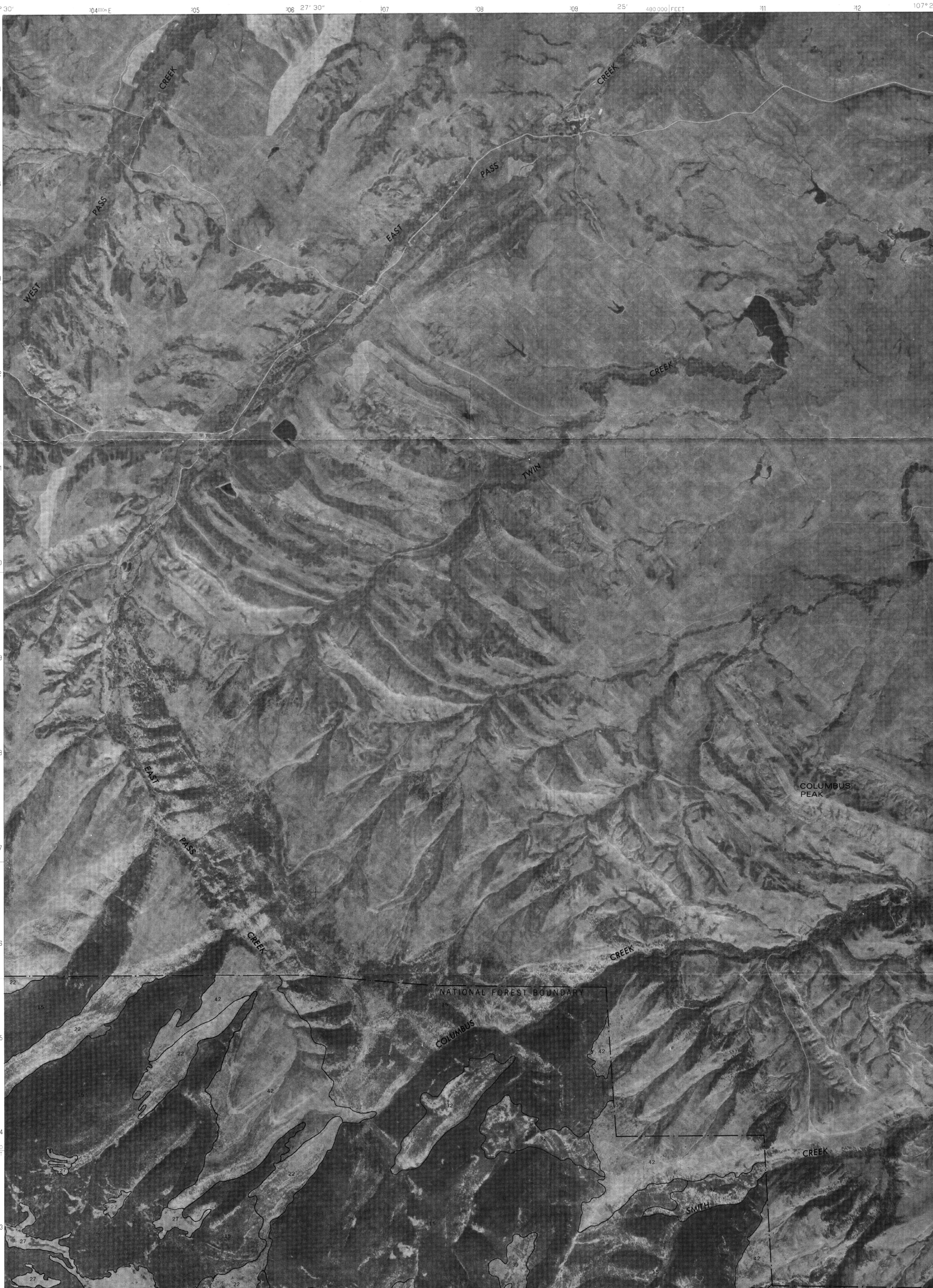
NORTH

WYOMING

QUADRANGLE LOCATION

This map was compiled by U.S. Department of Agriculture–Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

WEST PASS, WYO.
N4452.5–W10730/7.5



Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

SCALE 1:24 000

1 MILE

7000 FEET

1 KILOMETER

NORTH

WYOMING

QUADRANGLE LOCATION

COLUMBUS PEAK, WYO.
N4452.5—W10722.5/7.5

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Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 9, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

NORTH

WYOMING

QUADRANGLE LOCATION

MEDICINE WHEEL, WYO.
N4445—W10752.5/7.5

This map was compiled by U.S. Department of Agriculture—Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 7

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 9, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

SCALE 1:24 000

NORTH

WYOMING

QUADRANGLE LOCATION

This map was compiled by U.S. Department of Agriculture–Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

BALD MOUNTAIN, WYO.
N4445–W10745/7.5

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 8

SCALE 1:24 000

1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 9, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

NORTH

WYOMING

QUADRANGLE LOCATION

ICE CREEK, WYO.
N4445-W10737.5/7.5

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UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 9

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 9, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

WYOMING
QUADRANGLE LOCATION

BURGESS JUNCTION, WYO.
N4445–W10730/7.5

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Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

SCALE 1:24 000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

NORTH

WYOMING

QUADRANGLE LOCATION

SKULL RIDGE, WYO.
N4445–W10722.5/7.5

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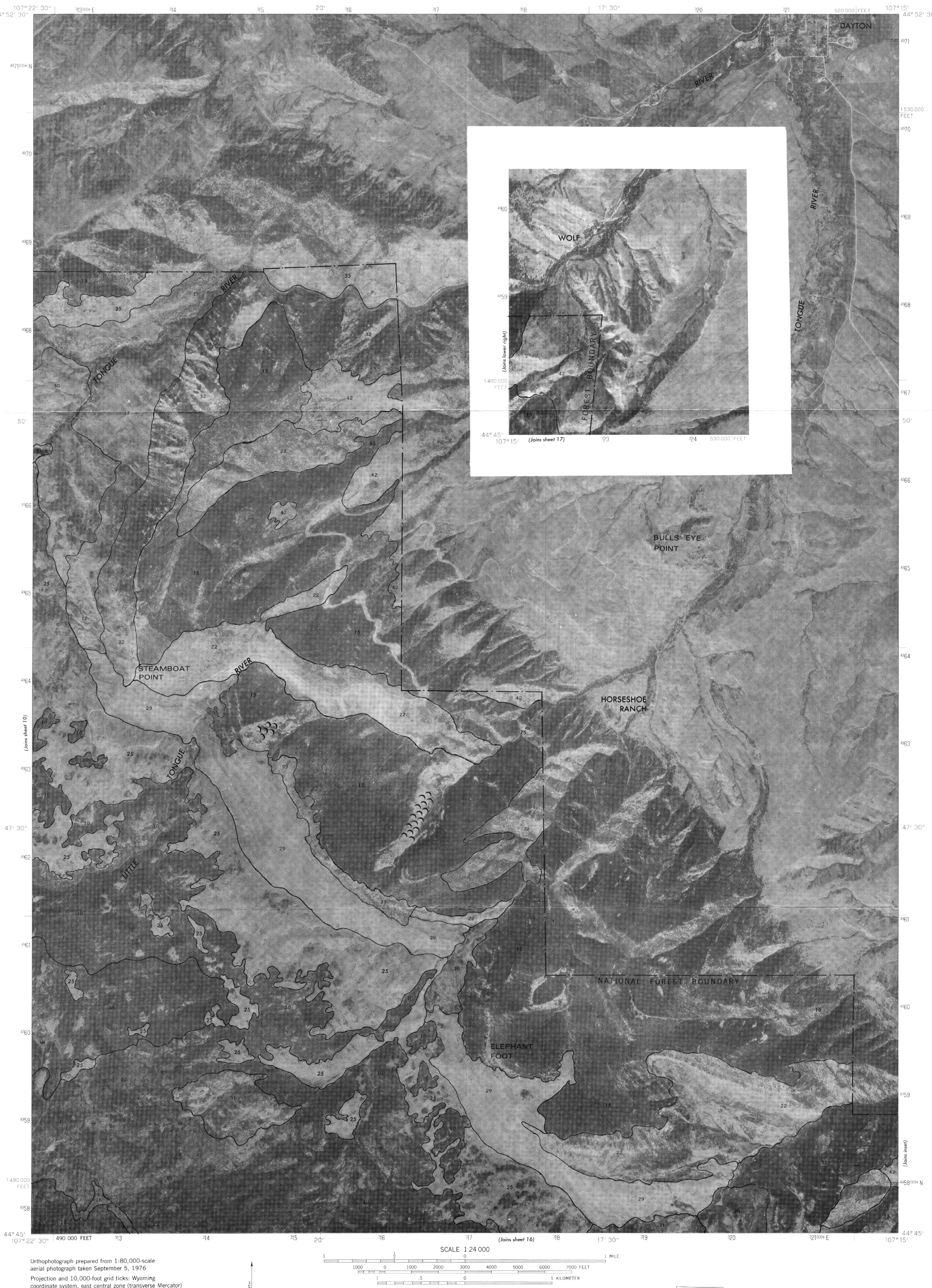
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 11



Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

WYOMING
QUADRANGLE LOCATION

DAYTON SOUTH, WYO.
N4445–W10715/7.5

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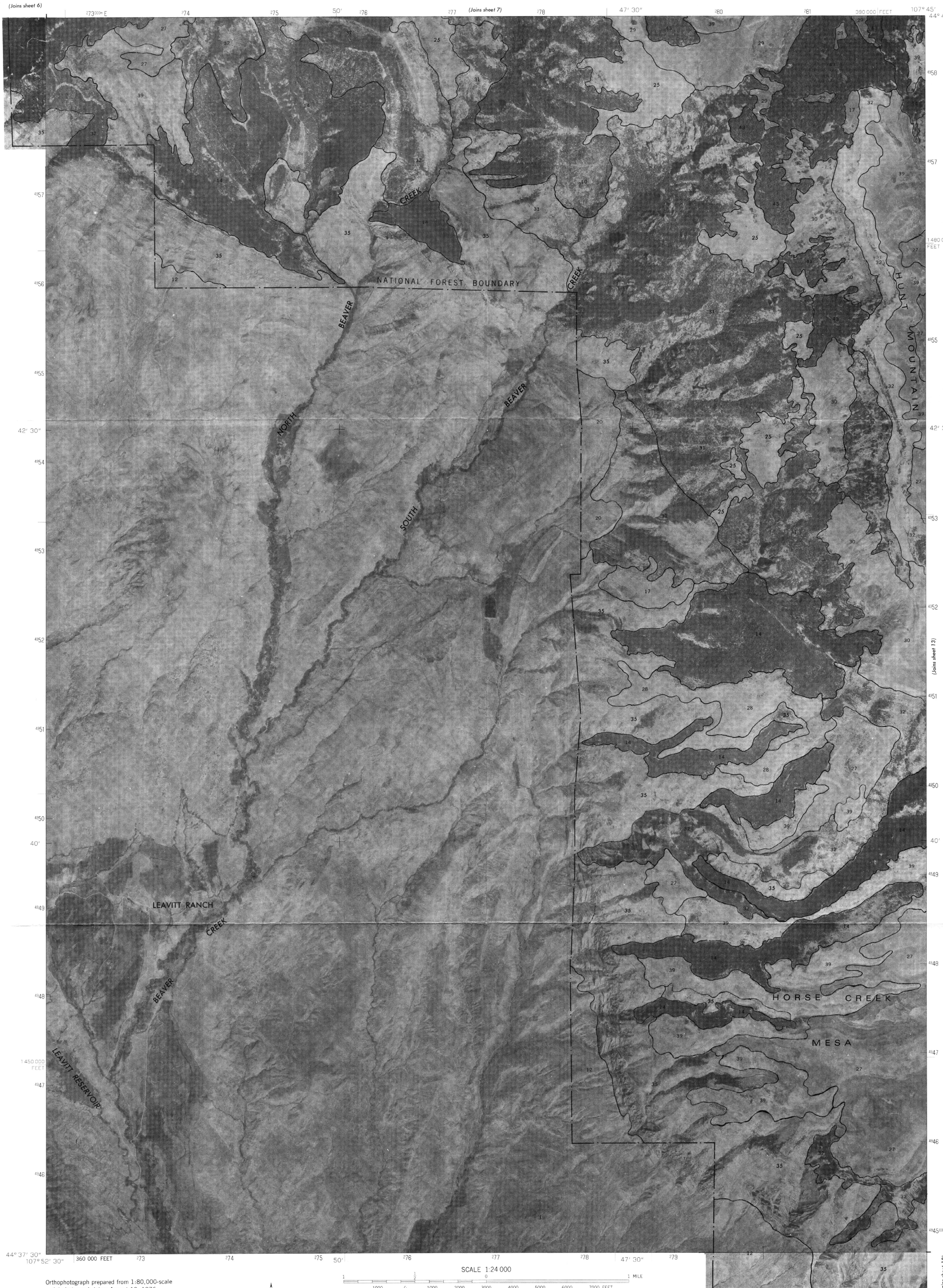
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 12



SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

NORTH

Orthophotograph prepared from 1:80,000-scale aerial photograph taken August 10, 1976
Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum
Photoimagery rectified by automatic correlation

WYOMING
QUADRANGLE LOCATION

LEAVITT RESERVOIR, WYO.
N4437.5—W10745/7.5

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DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 13

SCALE 1:24 000

1 MILE

7000 FEET

1 KILOMETER

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 9, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

NORTH

WYOMING

QUADRANGLE LOCATION

HIDDEN TEPEE CREEK, WYO.

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UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 14

SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

Orthophotograph prepared from 1:80,000-scale aerial photograph taken August 10, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

NORTH

WYOMING

QUADRANGLE LOCATION

GRANITE PASS, WYO.
N4437.5—W10730/7.5

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DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 15

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

WYOMING

QUADRANGLE LOCATION

WOODROCK, WYO.
N4437.5—W10722.5/7.5

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DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 16

SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

NORTH

WYOMING

QUADRANGLE LOCATION

WALKER MOUNTAIN, WYO.
N4437.5—W10715/7.5

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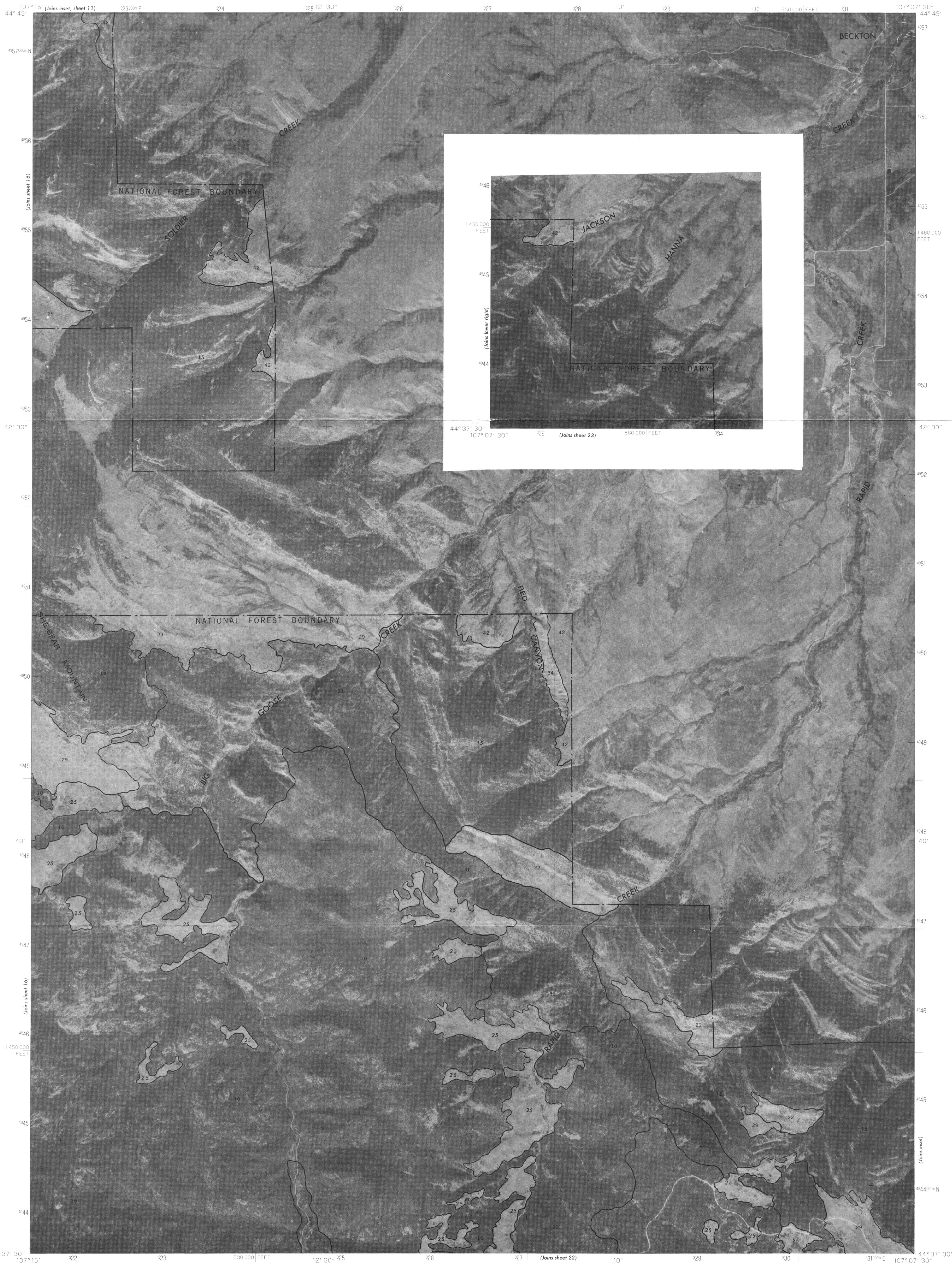
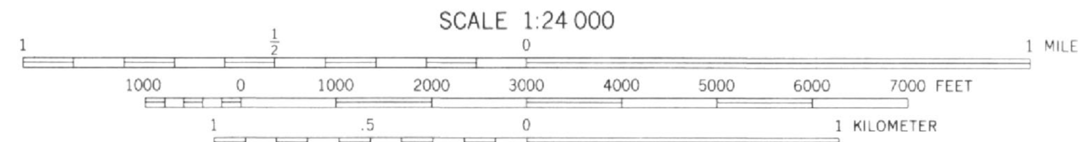


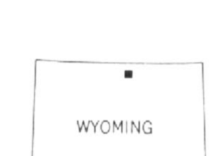


Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

NORTH



QUADRANGLE LOCATION

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BECKTON, WYO.
N4437.5–W10707.5/7.5

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 18

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 9, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

WYOMING

QUADRANGLE LOCATION

BLACK MOUNTAIN, WYO.
N4430—W10737.5/7.5

This map was compiled by U.S. Department of Agriculture—Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

NORTH

Orthophotograph prepared from 1:80,000-scale aerial photograph taken August 10, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

WYOMING

QUADRANGLE LOCATION

SHELL FALLS, WYO.
N4430-W10730/7.5

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(Joins sheet 15)

(Joins sheet 25)

SCALE 1:24 000

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

NORTH

WYOMING

QUADRANGLE LOCATION

SHELL RESERVOIR, WYO.
N4430-W10722.5/7.5

This map was compiled by U.S. Department of Agriculture-Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

NORTH

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

QUADRANGLE LOCATION

DOME LAKE, WYO.
N4430—W10715/7.5

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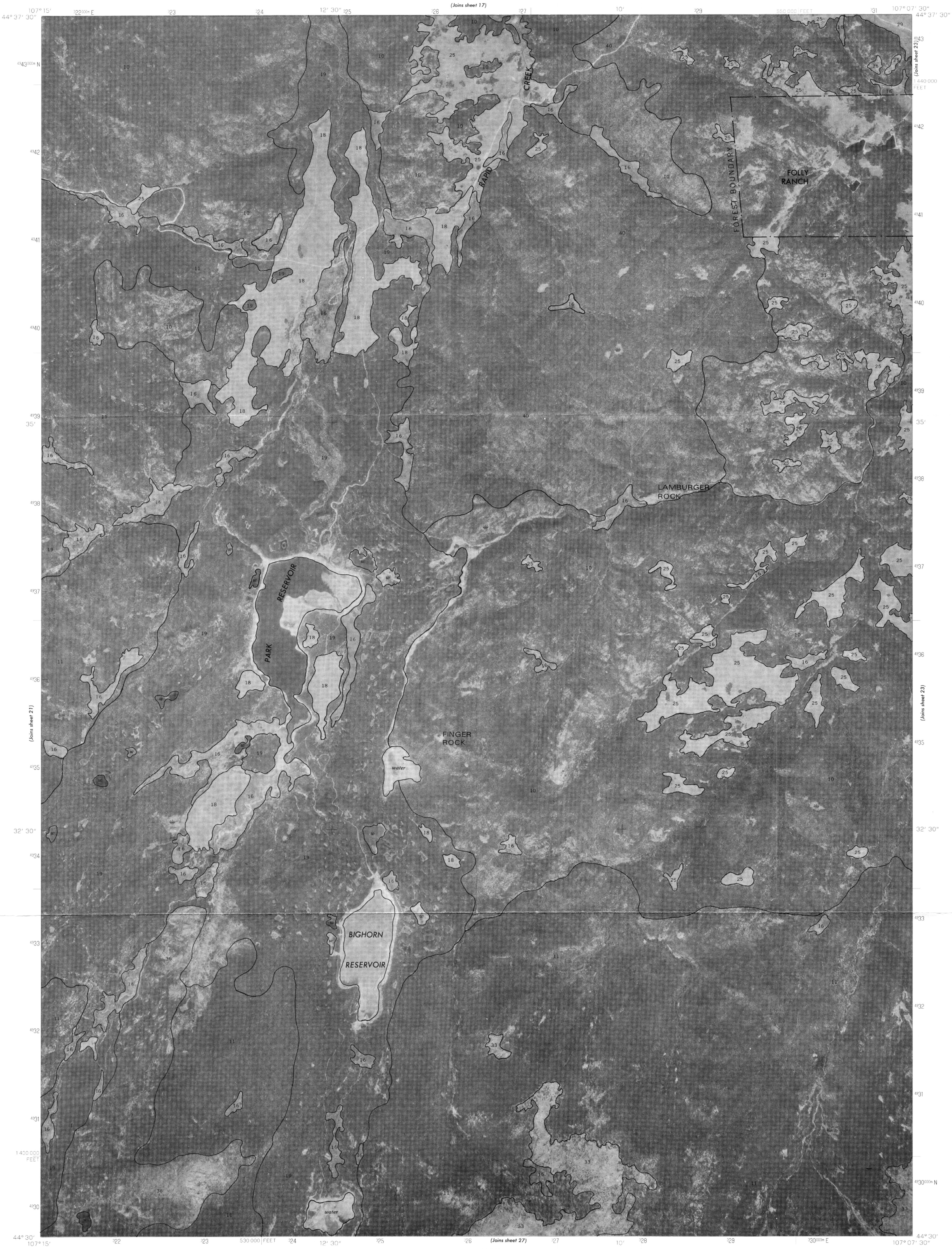
UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 22



SCALE 1:24 000

1 MILE

7000 FEET

1 KILOMETER

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

NORTH

WYOMING

QUADRANGLE LOCATION

This map was compiled by U.S. Department of Agriculture–Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

PARK RESERVOIR, WYO.
N4430–W10707.5/7.5

Sheet No. 22 of 44

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 23

SCALE 1:24 000

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

NORTH

WYOMING

QUADRANGLE LOCATION

LITTLE GOOSE PEAK, WYO.
N4430–W10700/7.5

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UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 24

SCALE 1:24 000

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

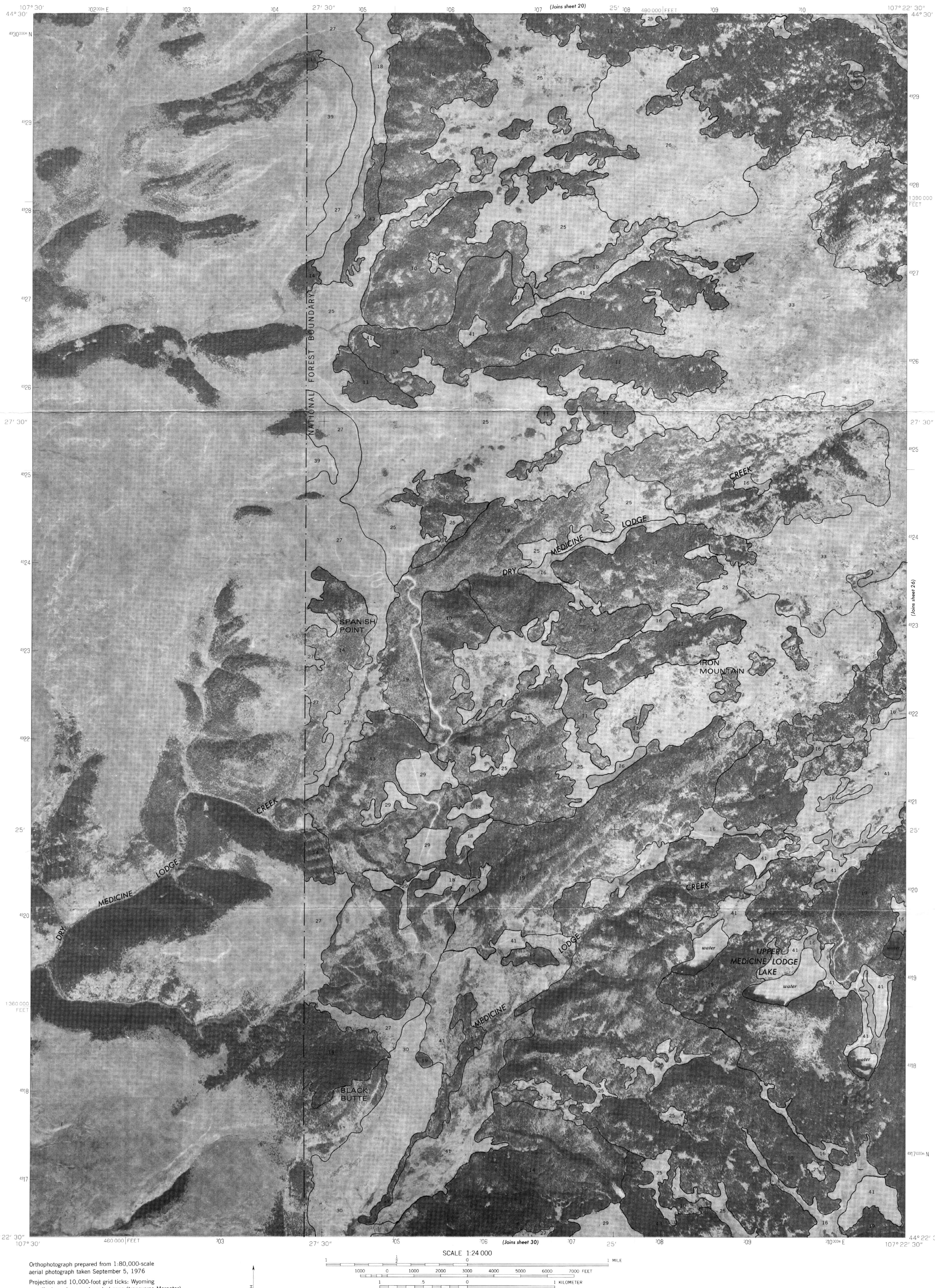
WYOMING
QUADRANGLE LOCATION

STORY, WYO.
N4430-W10652.5/7.5

This map was compiled by U.S. Department of Agriculture–Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 25



Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

WYOMING

QUADRANGLE LOCATION

This map was compiled by U.S. Department of Agriculture–Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

SPANISH POINT, WYO.
N4422.5–W10722.5/7.5

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 26

SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

NORTH

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

WYOMING

QUADRANGLE LOCATION

SHELL LAKE, WYO.
N4422.5—W10715/7.5

This map was compiled by U.S. Department of Agriculture—Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

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DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 27

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

SCALE 1:24 000

WYOMING

QUADRANGLE LOCATION

CLOUD PEAK, WYO.
N4422.5—W10707.5/7.5

This map was compiled by U.S. Department of Agriculture–Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 28

SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

NORTH

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

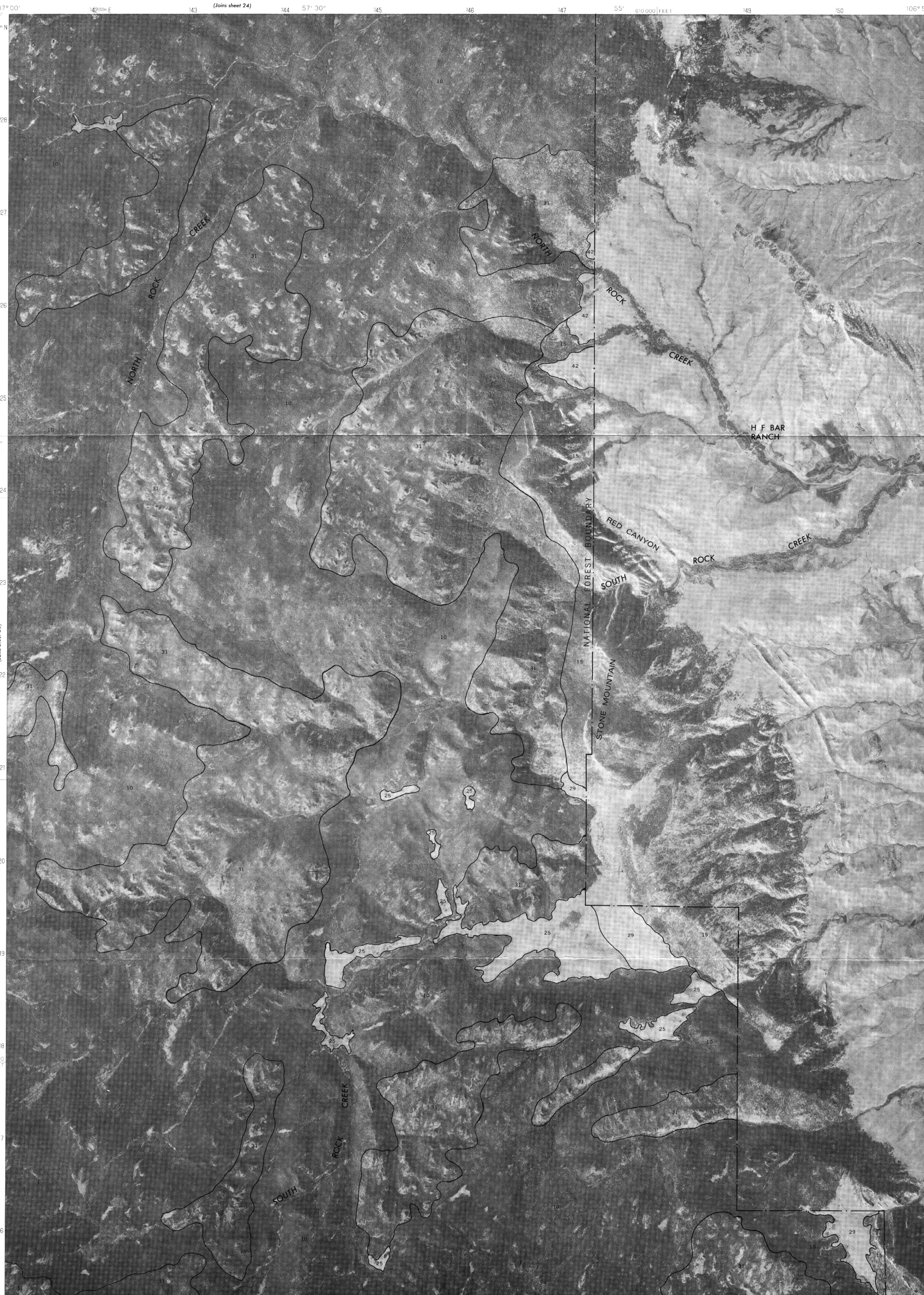
WYOMING

QUADRANGLE LOCATION

This map was compiled by U.S. Department of Agriculture–Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

WILLOW PARK RESERVOIR, WYO.
N4422.5–W10700/7.5

Sheet No. 28 of 44



SCALE 1:24 000

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

NORTH

DECLINATION

WYOMING

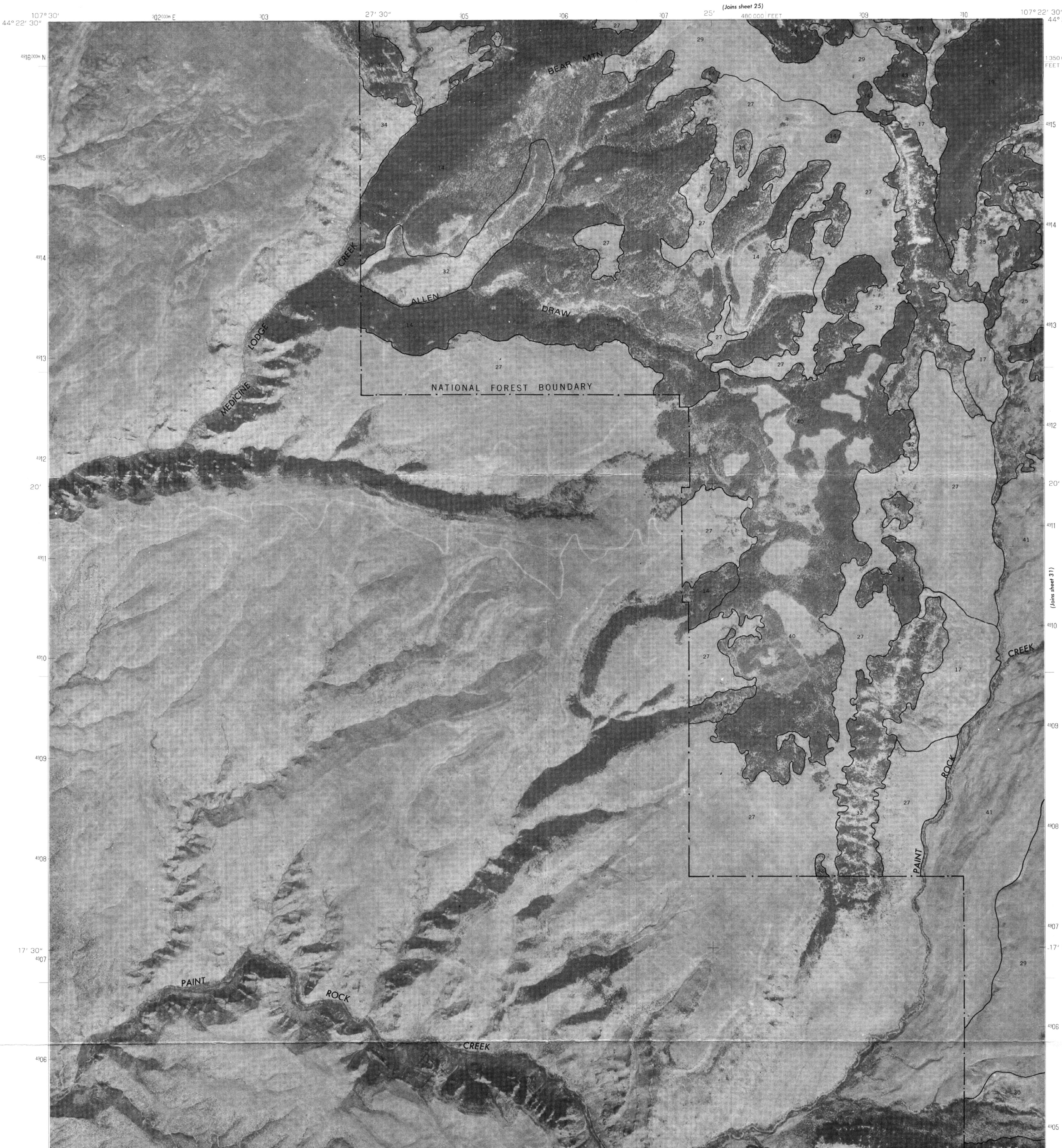
QUADRANGLE LOCATION

This map was compiled by U.S. Department of Agriculture–Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

STONE MOUNTAIN, WYO.
N4422.5–W10652.5/7.5

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 30



Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

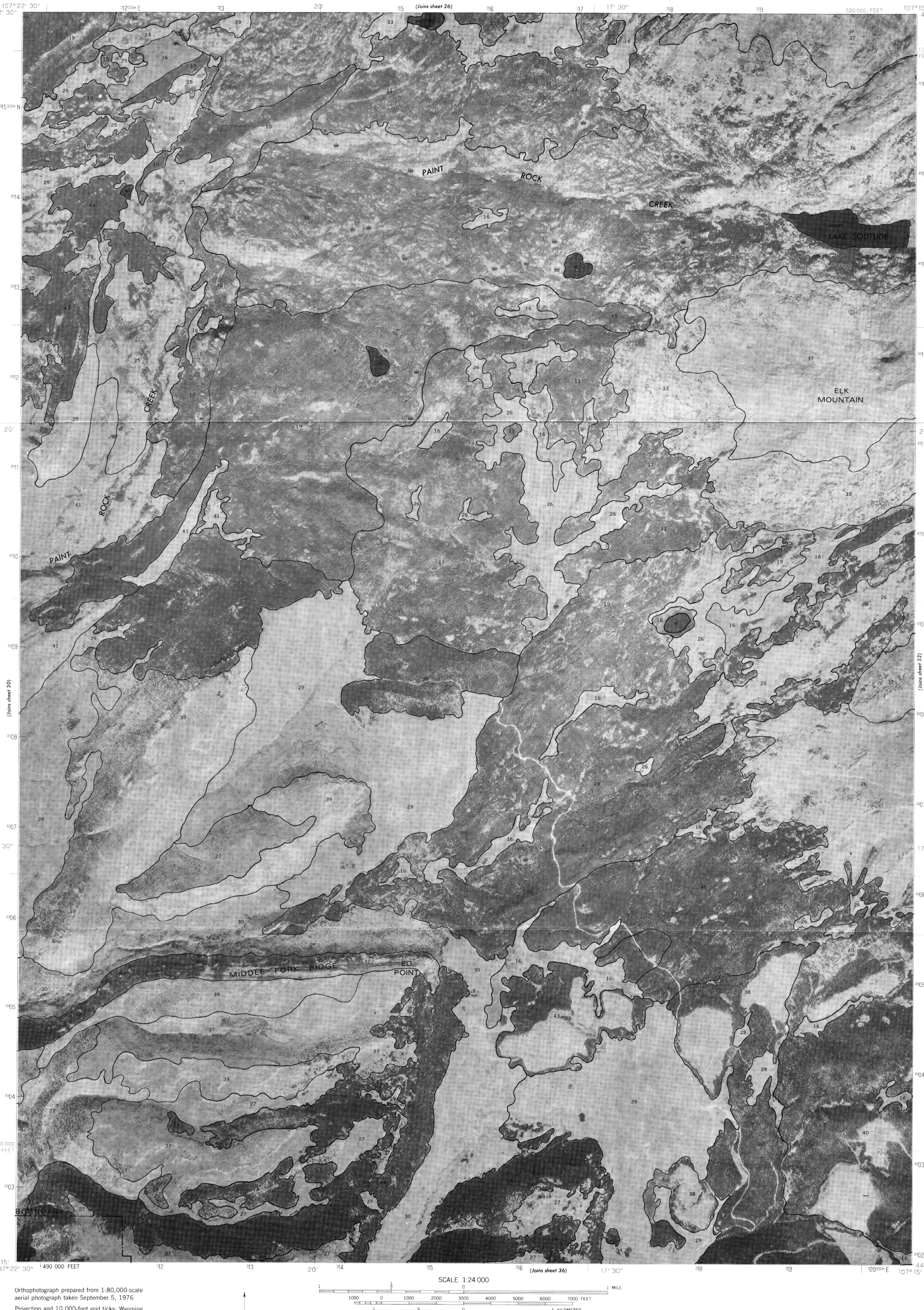
Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

WYOMING
QUADRANGLE LOCATION

ALLEN DRAW, WYO.
N4415—W10722.5/7.5

This map was compiled by U.S. Department of Agriculture—Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey



Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

WYOMING
QUADRANGLE LOCATION

This map was compiled by U.S. Department of Agriculture–Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

LAKE SOLITUDE, WYO.
N4415–W10715/7.5

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 32

SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

NORTH

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

WYOMING

QUADRANGLE LOCATION

LAKE HELEN, WYO.
N4415—W10707.5/7.5

This map was compiled by U.S. Department of Agriculture—Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

SCALE 1:24 000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 9, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

NORTH

WYOMING

QUADRANGLE LOCATION

LAKE ANGELINE, WYO.
N4415—W10700/7.5

This map was compiled by U.S. Department of Agriculture—Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 34

SCALE 1:24 000

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

NORTH

DECLINATION

WYOMING

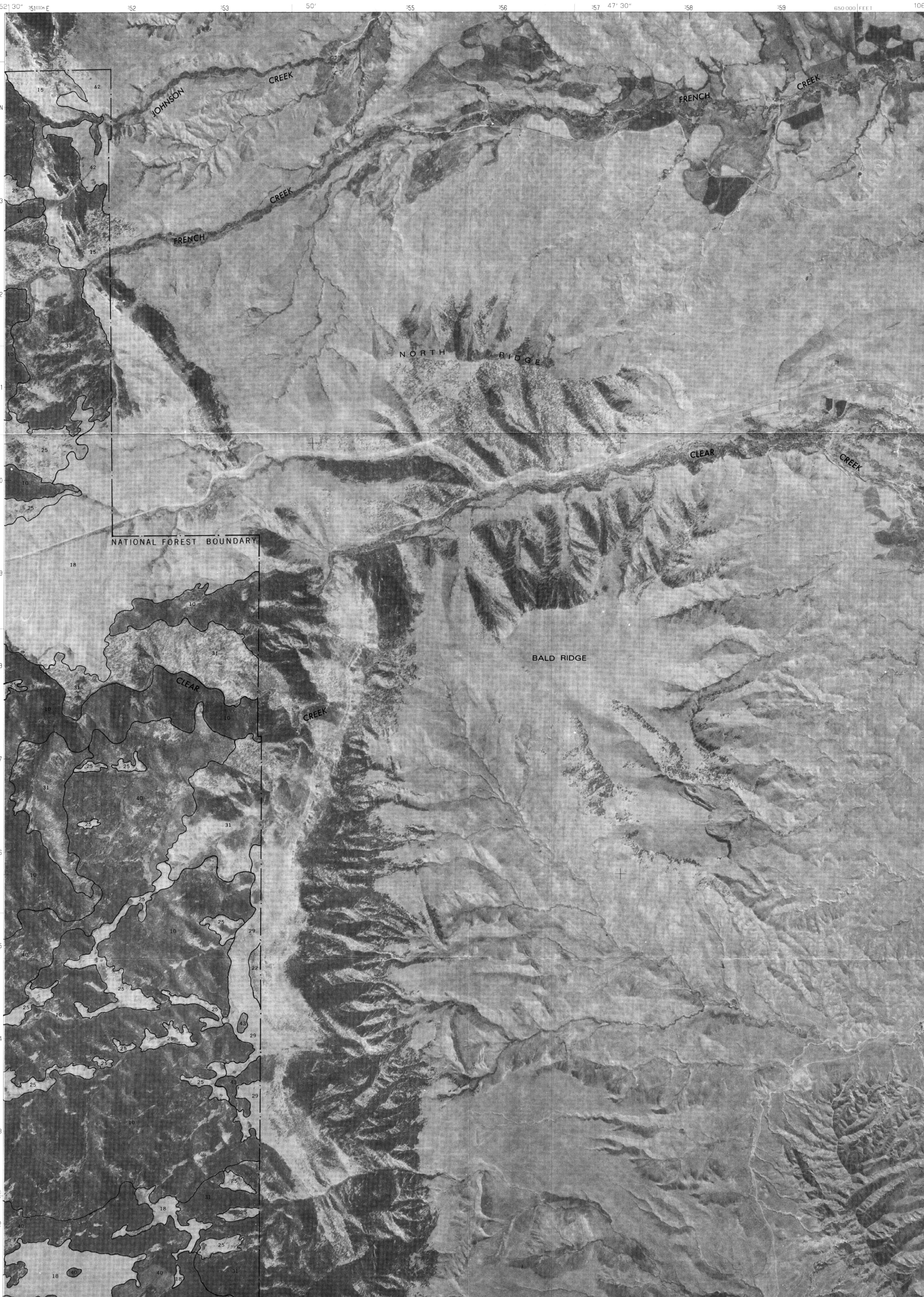
QUADRANGLE LOCATION

HUNTER MESA, WYO.
N4415—W10652.5/7.5

This map was compiled by U.S. Department of Agriculture—Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 35



SCALE 1:24 000

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

NORTH

WYOMING

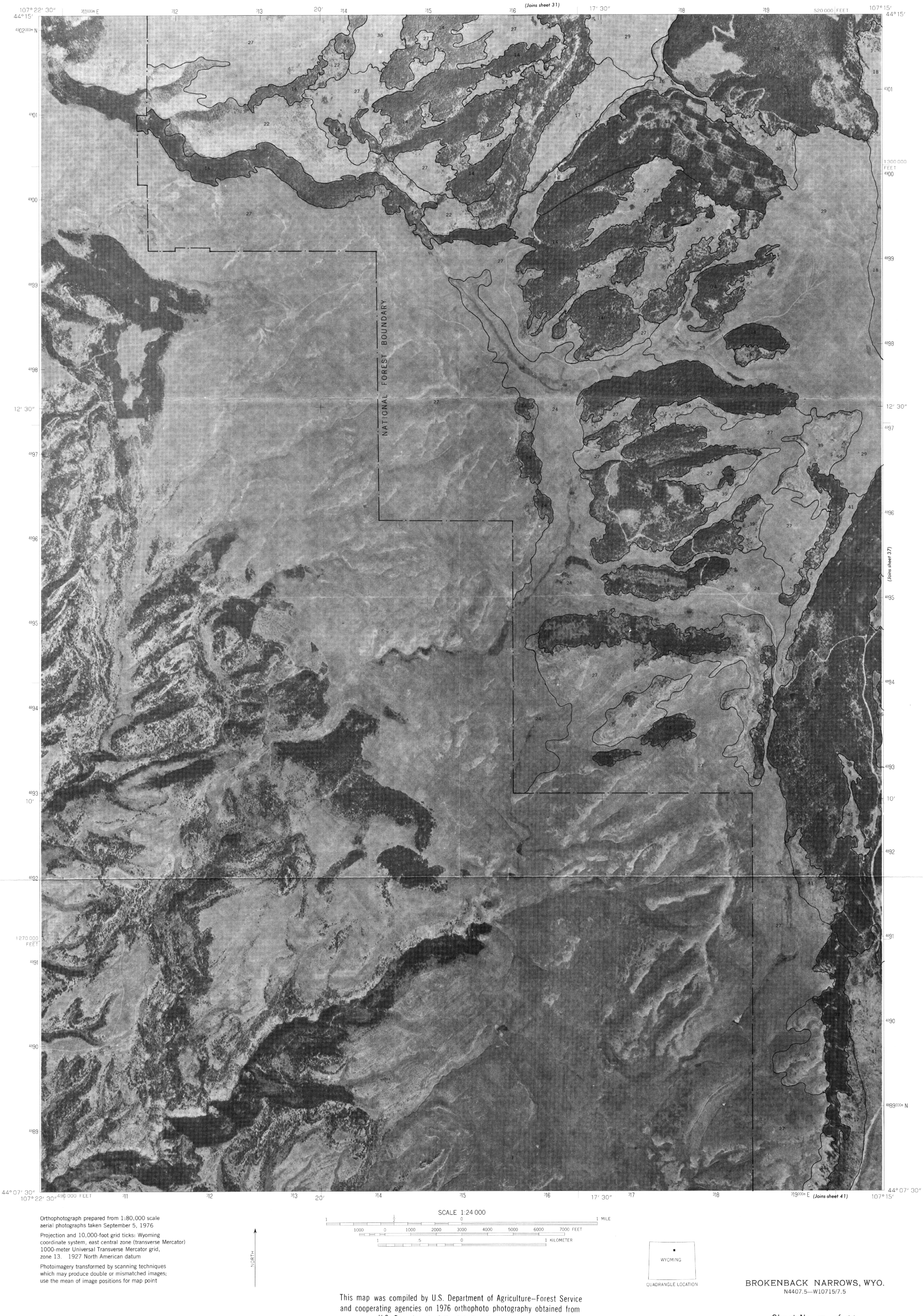
QUADRANGLE LOCATION

NORTH RIDGE, WYO.
N4415–W10645/7.5

This map was compiled by U.S. Department of Agriculture–Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 36



SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

Orthophotograph prepared from 1:80,000 scale aerial photographs taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery transformed by scanning techniques which may produce double or mismatched images; use the mean of image positions for map point

NORTH

WYOMING

QUADRANGLE LOCATION

BROKENBACK NARROWS, WYO.
N4407.5—W10715/7.5

This map was compiled by U.S. Department of Agriculture–Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 37

Orthophotograph prepared from 1:80,000 scale aerial photographs taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery transformed by scanning techniques which may produce double or mismatched images; use the mean of image positions for map point

SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

NORTH

WYOMING

QUADRANGLE LOCATION

MEADOWLARK LAKE, WYO.
N4407.5—W10707.5/7.5

This map was compiled by U.S. Department of Agriculture–Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 38

SCALE 1:24 000

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 9, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, west central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

NORTH

WYOMING

QUADRANGLE LOCATION

POWDER RIVER PASS, WYO.
N4407.5–W10700/7.5

This map was compiled by U.S. Department of Agriculture–Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

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FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 39

SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

NORTH

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

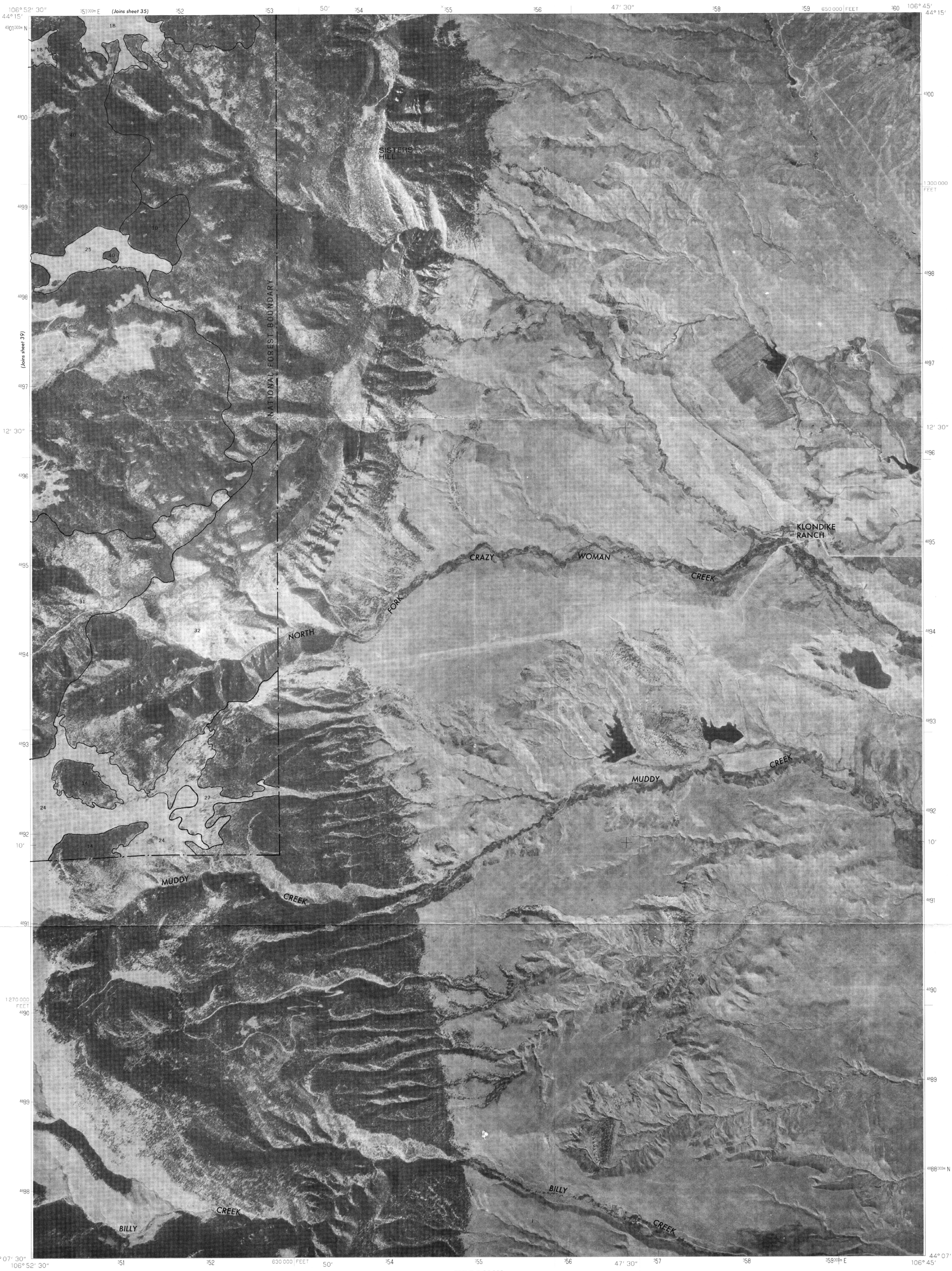
Photoimagery rectified by automatic correlation

WYOMING

QUADRANGLE LOCATION

CARIBOU CREEK, WYO.
N4407.5–W10652.5/7.5

This map was compiled by U.S. Department of Agriculture–Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey



Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

NORTH

SCALE 1:24 000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

QUADRANGLE LOCATION

KLONDIKE RANCH, WYO.
N4407.5—W10645/7.5

This map was compiled by U.S. Department of Agriculture–Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 41

Orthophotograph prepared from 1:80,000 scale aerial photographs taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery transformed by scanning techniques which may produce double or mismatched images; use the mean of image positions for map point

NORTH

SCALE 1:24 000

1 MILE

7000 FEET

1 KILOMETER

WYOMING

QUADRANGLE LOCATION

OLD MAID GULCH, WYO.
N4400—W10715/7.5

This map was compiled by U.S. Department of Agriculture–Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

Sheet No. 41 of 44

Orthophotograph prepared from 1:80,000 scale aerial photographs taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery transformed by scanning techniques which may produce double or mismatched images; use the mean of image positions for map point

NORTH

SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

WYOMING

QUADRANGLE LOCATION

ONION GULCH, WYO.
N4400—W10707.5/7.5

This map was compiled by U.S. Department of Agriculture–Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

SCALE 1:24 000

Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

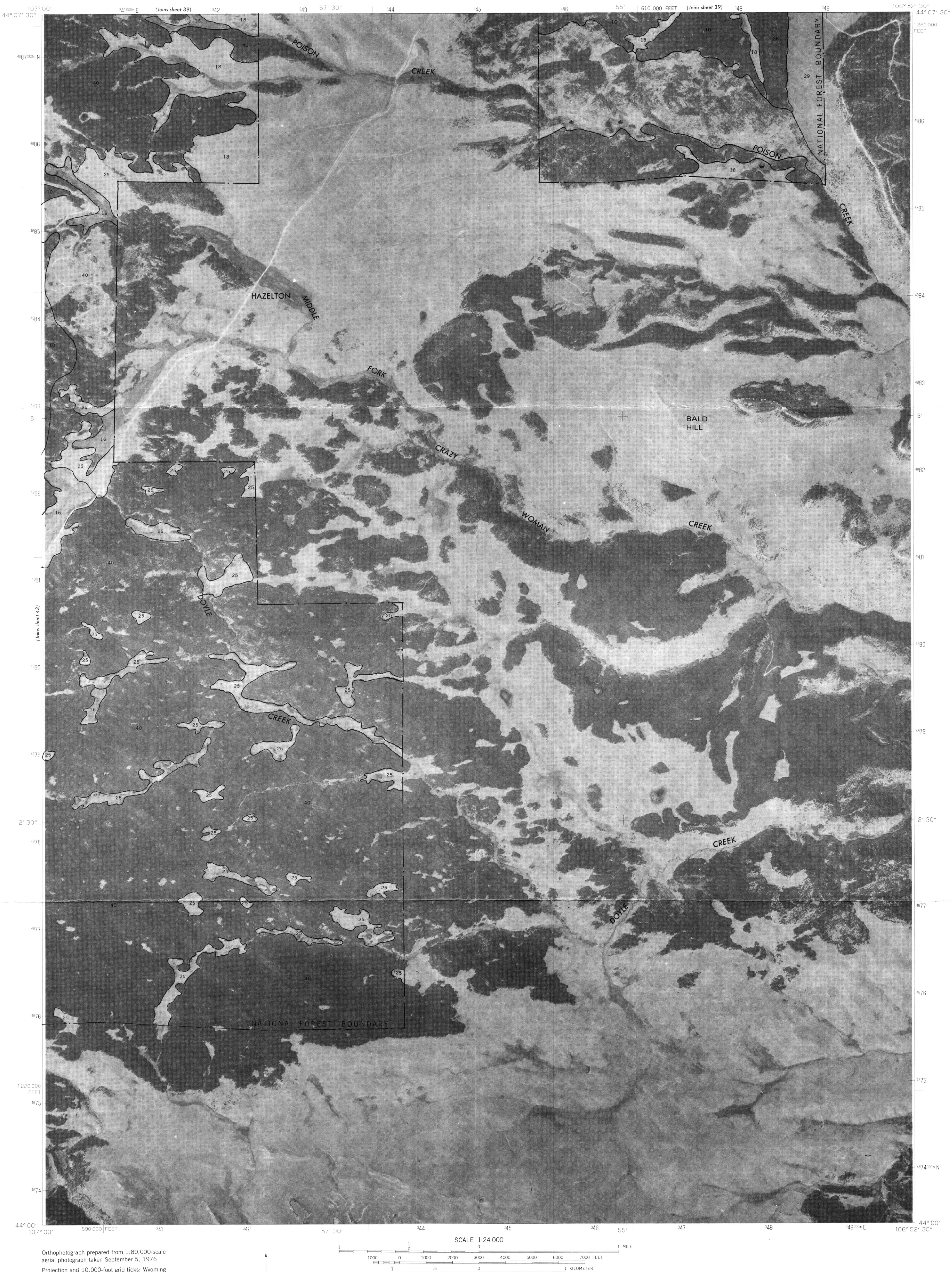
WYOMING
QUADRANGLE LOCATION

HAZELTON PEAK, WYO.
N4400–W10700/7.5

This map was compiled by U.S. Department of Agriculture–Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE R-2

BIGHORN NATIONAL FOREST
SOIL SURVEY AREA
SHEET NO. 44



Orthophotograph prepared from 1:80,000-scale aerial photograph taken September 5, 1976

Projection and 10,000-foot grid ticks: Wyoming coordinate system, east central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13. 1927 North American datum

Photoimagery rectified by automatic correlation

WYOMING
QUADRANGLE LOCATION

HAZELTON, WYO.
N4400–W10652.5/7.5

This map was compiled by U.S. Department of Agriculture–Forest Service and cooperating agencies on 1976 orthophoto photography obtained from U.S. Department of the Interior, Geological Survey